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THE
H I S T O R Y
OF THE
ROYAL SOCIETY of LONDON,
FOR IMPROVING OF
NATURAL KNOWLEDGE,
FROM ITS FIRST RISE.

IN WHICH

The most considerable of those Papers communicated to the
SOCIETY, which have hitherto not been published, are inserted in their
proper order,

AS A SUPPLEMENT TO
THE PHILOSOPHICAL TRANSACTIONS.

By THOMAS BIRCH, D.D.
SECRETARY to the ROYAL SOCIETY.

V O L. III.

*Talem intelligo PHILOSOPHIAM NATURALEM, quæ non abeat in fumos speculationum subtilium
aut sublimium, sed quæ efficaciter operetur ad sublevanda vitæ humane incommoda. BACON de
Augm. Scient. L. ii. c. 2.*

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1677.
Jan. 11.

MR. ISAAC NEWTON was elected.
Sir FRETCHVIL HOLLES was proposed candidate by the president.

Mention was made of Mr. NEWTON's improvement of telescopes by contracting them; and that that, which he had sent to the Society of that kind to be examined, had been by the king, and considered also by the president, Sir ROBERT MORAY, Sir PAUL NEILE, Dr. CHRISTOPHER WREN, and Mr. HOOKE at Whitehall; and that they had so good opinion of it, as they concluded, that a description and scheme of it should be sent by the secretary in a letter to Monf. HUYGENS* then at Paris, thereby to secure this contrivance to the author, who had also written a letter to Mr. OLDENBURG from Cambridge, dated January 6, 1677, altering and enlarging the description of his instrument, which had been sent him for his review, before it should go abroad.

This description was read, and ordered to be entere, together with the scheme, in the Register-book^b. Mr. NEWTON's letter was as follows^c:

* Mr. OLDENBURG's letter to Monf. HUYGENS was dated 1st January, 1677, and entered in the Letter-Book, vol. v. p. 92.

^b Vol. iv. p. 123. It is published in the Philosoph. Transact. vol. vii. n^o 81.

^c Letter-book, vol. v. p. 95.

" The description of the instrument you sent me is very well ; only the radius of the concave metal, which you put 14 inches, is more justly $12\frac{1}{2}$ or 13 inches, and the radius of the eye-glass, which you put half an inch, is the twelfth part of it, if not less : for the metall collects the sun's rays, at $6\frac{1}{2}$ inches distance, and the eye-glass at less than $\frac{1}{2}$ part of an inch distance from its vertex. By the tools also, to which they were ground, I know their dimensions, and particularly measuring the diameter of the hemispherical concave, in which the eye-glass was ground, I find it the 6th part of an inch.

" Perhaps it may give some satisfaction to Monsr. HUYGENS to understand in what degree it represents things distinct and free from colours, and to know the aperture, by which it admits light. And after the words [*—versus facum E reflectatur,*] it may not be amiss to add this note :

" Conferendo distantias foculi istius à verticibus lentis & speculi concavi, hoc est, EF $\frac{1}{2}$ dig. & ETV $6\frac{1}{2}$ dig. prodit ratio 1 ad 38, quâ judicatur objecta 38 vicibus circiter ampliari.

" And to this proportion is very consentaneous the observation of the crown on the weather-cock, for the scheme represents it bigger by $2\frac{1}{2}$ times, when seen through this, than through an ordinary prospective : and so supposing *that* to magnify 13 or 14 times (as by the description it should) *this* by experiment proportionably must magnify almost as much as I have assigned it.

" To the objection, that, with it, objects are difficultly found ; I may answer, that that's the inconvenience of all tubes, that magnify much ; and that after a little use the inconvenience will grow less ; for I could readily enough find any day-objects, by knowing which way they were pointed from other objects, that I accidentally saw in it ; but in the night to find stars I confess it troublesome enough : yet this may be easily remedied by two lights affixed to the iron rod, by which the tube is sustained. And such I once intended should have been made before I sent it away from me, but that I thought the defect would not be judged material. If such sights be not found a sufficient remedy, there may be an ordinary prospective-glass fastened to the same frame with the tube, and directed towards the same object, as DES-CARTES in his Dioptrics hath described for remedying the same inconvenience of his best telescopes.

" The plane side of the eye-glass is apt to be soiled with the dust falling upon it ; and therefore the little leading ring, put into the orifice of the bigger leaden barrel to moderate its aperture, must be sometimes taken out, and the glass wiped with leather, done upon the small end of a stick, or other such like contrivance : but care must be taken, that the said ring be not lost, for without it objects appear very confused at the edges of the apparent space. So if the concave metal contract any dullness, by moisture or otherwise, it ought to be taken out and rubbed with gentle leather, but not with putty, or any thing that may wear the metal.

" I am

"I am very sensible of the honour done me by the bishop of Sarum in proposing me candidate, and which I hope will be further conferred upon me by my election into the Society. And, if so, I shall endeavour to testify my gratitude, by communicating what my poor and solitary endeavours can effect towards the promoting philosophical design."

It was ordered, that a letter should be written by the secretary to Mr. NEWTON to acquaint him of his election into the Society, and to thank him for the communication of his telescopes, and to assure him, that the Society would take care, that all right should be done him with respect to this invention.

Mr. OLDENBURG acquainted the Society, that he had received from Mr. TENISON * an account of the practice of agriculture in Huntingdonshire, in a letter written to him from Holywell, November 1, 1671; which relation was ordered to be joined to others of that nature.

Mr. OLDENBURG read a letter to him by Mr. VERNON from Paris, January 9, 1671[†], describing the method observed by Monf. PICART in measuring the earth, whereby it appeared, that he assigned 57060 Parisian toises or fathoms, *numero rotundo*, to a degree, or seventy-three English miles, reckoning five thousand feet a mile.

Mr. HOOKE was exhorted to pursue and finish his way of measuring a degree, which he promised to do, hoping to bring it to a greater exactness and nearness.

Mr. OLDENBURG produced also a letter to himself, from signor CASSINI, dated at Paris, January 9, 1671[‡], concerning his observations lately made of a new planet near Saturn, the scheme whereof was delivered to Mr. HOOKE, to consider it, and thereupon to make the like observations.

January 18. Sir FRETCHVIL HOLLES was elected.

JOHN TILLOTSON, D. D. was proposed candidate by the lord bishop of Salisbury.

Mr. HORNECK presented the Society with some African curiosities, lately brought by a friend of his from Fez, viz.

1. A fair fruit of Coloquintida.
2. Coloquintida seed.
3. An herb called *albenna*, held for a panacea by the people of the country,
4. Another herb, good against sea-sickness; the name of which plant was not known to him.

* Afterwards archbishop of Canterbury.

† Letter-book, vol. v. p. 99.

‡ Ibid. p. 118.

5. A kind of mineral esteemed to be African lead-ore, of which some was given to Mr. BOYLE to examine it.

6. Some earth like fuller's earth, used there in washings before the people go into their temples.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated at York, January 10, 1671¹, concerning veins in plants analogous to human veins. He was desired to pursue his intentions of making farther observations on this subject.

Mr. NEWTON's new telescope was examined and applauded.

Mr. HOOKE made a proposition of a highly considerable improvement of all sorts of optic burning-glasses; which was this:

"The perfection of telescopes, microscopes, scotoscopes, and burning-glasses, from lentes of figures as easily and perfectly made as plain and spherical, by which the light and apparent magnitude of bodies may be most prodigiously and regularly increased; and whatever almost hath been in notion and imagination, or desired in optics, may be performed with great facility and truth."

The way of performing this he lodged in these characters:

a	c	e	f	i	l	n	o	p	r	s	t	u	x
4	4	8	3	4	2	2	4	2	6	4	3	4	2.

He received the thanks of the Society, and was desired to impart the thing itself to the president for his lordship's perusal.

January 25. Dr. TILLOTSON was elected.

There was produced a reflecting telescope of four feet long, of Mr. NEWTON's invention; which, tho' the metalline concave was not duly polished, yet did pretty well, but was undercharged.

It was ordered to be perfected against the next meeting.

Sir ROBERT MORAY shewed the Society a small piece of opaque glass made by Mr. BOYLE, to serve for reflecting concaves.

It was ordered, that Mr. BOYLE should be asked, whether larger pieces could be made of it for the use of Mr. NEWTON's telescopes.

Mr. OLDENBURG read a letter to himself from Mr. NEWTON, dated Cambridge, 18 January, 1671², containing an intimation, 1. Of a way of preparing a fit

¹ Letter-book, vol. v. p. 123. It is printed in the Philos. Transact. vol. vi. n° 79. p. 3052. for January, 1671.

² Letter book, vol. v. p. 142.

metalline

metalline matter for reflecting concaves. 2. Of a considerable philosophical discovery, which he intended to send to the Society to be considered of and examined. It was as follows:

" Understanding by your last, that some of the fellows of the honourable Society, in order to a bigger reflective telescope, are devising a fit metalline matter, let me presume to give them this caution, that whilst they seek for a white, hard, and durable metalline composition, they resolve not upon such an one, as is full of small pores, only discoverable by a microscope: for tho' such an one may, to appearance, take a good polish, yet the edges of those small pores will wear away faster in the polishing than the other parts of the metal; and so however the metal seem polite, yet it shall not reflect with such an accurate regularity as it ought to do. Thus tin-glass, mixt with ordinary bell-metal, makes it more white, and apt to reflect a greater quantity of light; but withal its fumes raised in the fusion like so many aerial bubbles fill the metal full of those microscopical pores: but white arsenic both blanches the metal, and leaves it solid, without any such pores, especially if the fusion hath not been too violent. What the stellate regulus of Mars (which I have sometimes used) or other such like substance will do, deserves particular examination. Let me add further this intimation, that putty, or other such like powder, with which it is polished, by the sharp angles of its particles fretteth the metal, if it be not very fine, and filleth it full of such small holes as I speak of. And therefore care must be taken of that before judgment be given, whether the metal be throughout the body of it porous or not.

" I desire, that in your next letter you would inform me, for what time the Society continue their weekly meetings; because if they continue them for any time, I am purposing them, to be considered of and examined, an account of a philosophical discovery, which induced me to the making of the said telescope; and I doubt not but will prove much more grat-ful than the communication of that instrument, being, in my judgment, the oddest, if not the most considerable detection, which hath hitherto been made in the operations of nature."

It was ordered, that Mr. NEWTON be thanked for his respect to the Society, and desired to let them know the proportions of the ingredients mentioned by him in his letter, arsenic and bell metal; as also to impart to them the intimated discovery, as soon as he conveniently could.

Mr. OLDENBURG read an account of a method of reviving animals drowned, in a letter to him from Dr. HIERNE, a member of the Society, dated at Paris^b. It was as follows:

" Having the honour to be a member of the illustrious Royal Society, I think myself highly obliged to contribute what I can (though that can be but very

^b Letter-book, vol. v. p. 67.

^c little)

little) to the advance of their design. Though I have met with many curious things, since my leaving England, yet I do not think them of importance enough to present you with them; yet among them there is one thing, which seems philoſophical enough and uſeful, if it could be brought to perfection and into practice; that is, a way of reviving animals drowned, and that even after they have been ſo, many hours. Here is one, that hath already made ſome experiments concerning it. He made one, two or three months ago, which ſucceeded in part. He took a dog, which having been drowned three days before, he made him to ſtir, though he brought him not quite to life again. It was thought, that the reaſon, why he revived not altogether, was, becauſe the dog had not been drowned in a river, but in a barrel, in which there was not air enough to entertain life. This perſon maketh as yet a ſecret of his art; but, I know, that in Finland and the neighbour countries it often comes to paſs, that perſons, after they have been drowned two or three days, come to life again. The main of the art conſiſts in the manner of drawing them out of the water; about which I once diſcourſed largely with Monſ. LEYONBERG, the reſident of Sweden. In ſhort, it is this; that as ſoon as they have found the perſon drowned, they draw him up very gently towards the ſurface of the water, yet without bringing him haſtily into the air, to the end, that the raw and groſs air may not get into him impetuoſly, and mingle with the water, that is yet in the lungs; and laſt, when the circulation of the blood comes to be made again, the blood does not burſt the pulmonic veins, and ſo by the crudity of the water, the vital warmth of the heart be not extinguished: whence it is obſerved in almoſt all drowned perſons, that are not drawn up with that care, that the blood iſſues out of their mouth; which alſo happened to the dog above mentioned; and when that caſe happens, there is not any hope left of recovery. Wherefore the Finlanders having found the drowned body, they draw him gently towards the ſurface of the water, and preſently cover him with a thick cover, and carry him into a hot ſtove, where they put him upon a tun, and roll him gently to and fro, beginning firſt with a very gentle motion, and afterwards by degrees increaſing the agitation, whereby the water comes out of the mouth, noſe, and other oriſes. And the water being come away, and the pores opened, they rub the patient with hot linen cloths, and uſe other ſomentations, and then he begins to live again little by little; and after ſome days or weeks (ſome ſooner, ſome later, according to the force and conſtitution of the patient) they often are revived. It is obſerved, that thoſe, which thus eſcape, have loſt much of their vivacity, and that they are afterwards almoſt always very dull, and that their memory is much impaired; which doubtleſs happens, becauſe the blood hath been plentifully caſt into the head, and ſo diſorders the functions of the brain and ſpirits: to which alſo may much contribute the coldneſs of the water entering into the noſe and ears. But to return to the Pariſian artiſt, I do not yet know the means he uſeth. I know only thus much, that he maketh uſe of clyſters, the better to evacuate the water out of the bowels, which is not practiſed in the countries I ſpoke of. This I know alſo, that he puts aſhes over the body, which doubtleſs he doth in imitation of what happens to flies, which are revived being put in warm aſhes, after they have been drowned. Perhaps the aſhes may open

“ the pores, and by their sharpness may somewhat irritate the spirits, and bring them into motion again, the which yet, I think, may be better done by rubbing with hot linen cloths.

“ Before I conclude my letter and this account, I cannot but impart to you one thing more relating to this matter: Monf. OXHUWEN, a Swedish gentleman, very judicious and of great veracity, hath lately assured me, that some years ago, in the parish of Botnare in Sweden, the place of his residence, situate three leagues from Jouko, ing, a youth of fifteen or sixteen-years of age fell into the water when he was fishing, whence he was not drawn up till the third day after, and was recovered after the manner above described. And he added, that the father said, he had lain in the water without any trouble, hearing what was said concerning him above water, and relating what his father had said in seeking him. But he lived but six months after this accident, and was quite changed in his temper, being very melancholy; whereas before he was very cheerful. Another Swede assured me likewise, that being at Upsal he fell also into the river, whence he was drawn up an hour after, having heard, during the time, all what had been said on the river-side.

“ I could tell you many more histories of this nature, but I would not be tedious. You know what STIERNHJELM, a Swedish counsellor, one of the Royal Society, wrote to you a year ago, of a gardener, that was fallen into the water near that town, and how he was revived a good while after.

“ I shall only add, that though those, that are hanged and strangled, die soon, yet that is another thing, because there wants not all air to a drowned animal, as there doth to one that is strangled. And although the lungs, by reason of the abundance of water got in, cannot perform their function; yet since the water cannot enter into the heart, nor the arteries and veins, the circulation of the blood is not quite stopped, but only hindered; so that it cannot be made but very slowly and insensibly, after the manner as in apoplexies or hysterical suffocations. If the passage of the nourishment is obstructed, and that the chyle cannot pass, it is to be considered, that the vital heat also is very weak in this case, and consequently that the consumption of the blood, spirits, and nutriment is but small, and in a manner the same as it is in the bears of Lapland and Finland, which sleep whole months without eating any thing. Mean time, I acknowledge, that it is quite another thing, when persons fall into the sea, or into foul and troubled waters, the pores whereof are filled with other parts, and consequently cannot contain so much air as fresh and clear water doth.”

It was ordered, that the physicians of the Society and other members should be desired to make experiments of this kind upon dogs.

Dr. BROWN presented a remarkable kind of fine black, sent to his father, Sir THOMAS BROWN, out of Iceland, seeming to agree with the *lapis obsidianus* men-

mentioned by PLINY, out of which the four elephants in the Temple of Concord, and the statue of MENELAUS found by TIBERIUS in Ægypt, were made.

It was delivered to CHRISTOPHER COCKS the perspective-maker, to try whether it would be fit for reflecting concaves.

Dr. BROWN produced likewise a sort of small black stones, seeming to be black pebbles, found upon the ground in many places of Iceland: as likewise a sort of natural sulphur digged out of the earth in the same island, found in several places there, and at great distances from the burning Hecla.

Dr. WREN intimated, that his highness Prince RUPERT had a way of making black lead run like a metal in a mould, so as to serve for black lead again.

The president being desired to declare to the Society, whether he had considered of Mr. HOOKE's late proposition of bringing telescopes and microscopes, &c. to perfection, said, that he had not yet had time to examine it well; but, by what he had seen, he could not but have a good opinion of it.

This was seconded by Dr. WREN, who had also been made acquainted with it by the inventor.

The Society urged the president and Mr. HOOKE, that something might be undertaken in this matter, that might convince the world of the reality thereof.

Mr. HOOKE was put in mind of the experiment of forcing mercury and air through wood.

Feb. 1. The four foot telescope of Mr. NEWTON's invention was produced again, being improved since the last meeting. It was recommended to Mr. HOOKE, to see it perfected as far as it was capable of being.

Mr. HOOKE was put in mind to give, as soon as he could, a specimen of his great proposition of making telescopes, microscopes, &c. in perfection.

A paper sent to Dr. BROWN from his father, concerning a bulimia in a woman of one hundred and two years old, was read.

The experiments of reviving animals drowned were again recommended to the physicians of the Society, and particularly to Dr. TIMOTHY CLARKE, who promised, that he would do his part in making such trials.

Mr. VERNON's letters to Mr. OLDENBURG from Paris, January 9, 27, and 30, 1672^a, containing an account of the mensuration of the earth by Mons. PICART, were read: as was also,

^a Letter-book, vol. v. p. 99.

A letter of Mr. FLAMSTEAD to Mr. OLDENBURG, dated at Derby, 23 December, 1671, was read, containing his promised Appendix of the moon's ap-
pulses to some of the Pleiades, to be observed in the year 1672¹.

Feb. 8. Five letters to Mr. OLDENBURG were read :

1. Of Dr. WALLIS, dated February 5, 1671, intimating, that from several late observations of his he conjectured, that the moon's perigee and apogee might much influence the rising and falling of the mercury in the barometer. This was recommended to those members of the Society, who had barescopes, for further observation.

2. Of signor CORNELIO, in Italian, from Naples, of January 29, 1671², declaring, that the stories related of the odd effects of the tarantula's stinging were in his opinion fictitious; and that, from many of his own observations, he was induced to believe, that without any preceding bite of that insect, such symptoms befall many of those people who live in Apulia, a very dry country, and are often tormented with an excessive and long thirst. He promised, within a short time, to enlarge himself upon this subject, with many more observations³.

3. Of Mr. ISAAC NEWTON from Cambridge, 6 February, 1671, concerning his discovery of the nature of light, refractions, and colours; importing, that light is not a similar, but a heterogeneous body, consisting of different rays, which had essentially different refractions, abstracted from bodies through which they pass; and that colours are produced from such and such rays, whereof some, in their own nature, are disposed to produce red, others green, others blue, others purple, &c. and that whiteness is nothing but a mixture of all sorts of colours, or that it is produced by all sorts of colours blended together.

It was ordered, that the author be solemnly thanked, in the name of the Society, for this very ingenious discourse⁴, and be made acquainted, that the Society think very much of it, if he consent to have it forthwith published⁵, as well for the greater convenience of having it well considered by philosophers, as for curing the considerable notions of the authors against the pretensions of others.

It was ordered also, that this discourse be entered into the register-book⁶; and that the bishop of Salisbury, Mr. Boyle, and Mr. Hooke be desired to peruse and consider it, and bring in a report of it to the Society.

¹ It is printed in the Philos. Transact. vol. vi. n^o 29. p. 306. for January, 1672.

² Letter-book, for January, 1671.

³ Mr. OLDENBURG, in his answer to signor CORNELIO, dated 9th February, 1671, inserted in the Letter-book, vol. v. p. 159, requested him to impart his observations to the Royal Society.

⁴ Mr. OLDENBURG's letter to Mr. NEWTON for this purpose is dated February 8, 1671, and entered in the Letter-book, vol. v. p. 157.

⁵ It is printed in the Philosoph. Transact. n^o 80, p. 307, for February, 1671.

⁶ Vol. iv. p. 134.

4. Of Mr. FLAMSTEAD, dated at Derby, 5th February, 1672¹, containing some of his late observations concerning the satellites of Jupiter.

5. Of Dr. HANNEMAN, physician of Buxtehude in Germany, dated 3d January, 1672, expressing his great esteem of the Society, and desiring their judgment on the matter of sanguification, and how it is performed.

It was ordered, that he should be thanked for his respect to the Society, and made acquainted, that it is not their custom to be hasty in delivering their judgment in any philosophical matters; but that all things of that nature are committed by them to observations and experiments frequently and carefully made.

Feb. 15. The minutes of the last meeting being read, and there occurring Dr. WALLIS's observation about the more than ordinary height of the mercury in the baroscope at the time of the moon's perigee, Mr. HOOKE mentioned, that by his observations that of the doctor did not hold, he having often remarked, that the quicksilver remained at almost one and the same height for a long while, and even for months together in summer.

It was thought desirable, that this matter might be farther observed with care by those, who had baroscopes.

The business of tarantula's likewise being again mentioned, and some of the members remarking, that it would be hard to accuse of fraud or error Ferdinand Imperato and other good authors, who had delivered, from their own experience, so many mischievous effects of the bite of tarantula's, it was ordered, that the secretary should desire to know of Dr. CORNELIO, who denied such effects, what he could say to the writings of those famous men concerning this matter.

Mr. HOOKE's considerations upon Mr. NEWTON's discourse on light and colours were read. Mr. HOOKE was thanked for the pains taken in bringing in such ingenious reflections; and it was ordered, that this paper should be registred*, and a copy of it immediately sent to Mr. NEWTON: and that in the mean time the printing of Mr. NEWTON's discourse by itself might go on, if he did not contradict it; and that Mr. HOOKE's paper might be printed afterwards, it not being thought fit to print them together, lest Mr. NEWTON should look upon it as a disrespect, in printing so sudden a refutation of a discourse of his, which had met with so much applause at the Society but a few days before.

Mr. HOOKE's paper was as follows:

" I have perused the discourse of Mr. NEWTON about colours and refractions, and I was not a little pleased with the niceness and curiosity of his observations.
" But, tho' I wholly agree with him as to the truth of those he hath alledged,

* Letter-book, vol. v. p. 155.

* Register, vol. iv. p. 148.

" as

“ as having, by many hundreds of trials, found them so; yet as to his hypothesis of solving the phenomena of colours thereby, I confess, I cannot see yet
 “ any undeniable argument to convince me of the certainty thereof. For all
 “ the experiments and observations I have hitherto made, nay, and even those
 “ very experiments, which he alledgeth, do seem to me to prove, that *whiteness*
 “ is nothing but a pulse or motion, propagated through an homogeneous, uni-
 “ form, and transparent medium: and that colour is nothing but the distur-
 “ ance of that light, by the communication of that pulse to other transparent me-
 “ diums, that is, by the refraction thereof: that *whiteness* and *blackness* are no-
 “ thing but the plenty or scarcity of the undisturbed rays of light: and that
 “ the two colours (than the which there are not more uncompounded in nature)
 “ are nothing but the effects of a compounded pulse, or disturbed propagation
 “ of motion caused by refraction.

“ But, how certain soever I think myself of my hypothesis (which I did not take
 “ up without first trying some hundreds of experiments) yet I should be very glad
 “ to meet with one *experimentum crucis* from Mr. NEWTON, that should divorce me
 “ from it. But it is not that, which he so calls, will do the turn; for the same phæ-
 “ nomenon will be solved by my hypothesis, as well as by his, without any man-
 “ ner of difficulty or straining: nay, I will undertake to shew another hypothesis,
 “ differing from both his and mine, that shall do the same thing.

“ That the ray of light is as it were split or rarified by refraction, is most cer-
 “ tain; and that thereby a differing pulse is propagated, both on those sides, and
 “ in all the middle parts of the ray, is easy to be conceived: and also, that differ-
 “ ing pulses or compound motions should make differing impressions on the eye,
 “ brain, or sense, is also easy to be conceived: and that, whatever refracting me-
 “ dium does again reduce it to its primitive simple motion by destroying the ad-
 “ ventitious, does likewise restore it to its primitive whiteness and simplicity.

“ But why there is a necessity, that all those motions, or whatever else it be
 “ that makes colours, should be originally in the simple rays of light, I do not
 “ yet understand the necessity of, no more than that all those sounds must be in
 “ the air of the bellows, which are afterwards heard to issue from the organ-
 “ pipes; or in the string, which are afterwards, by different stoppings and strik-
 “ ings produced; which string (by the way) is a pretty representation of the shape
 “ of a refracted ray to the eye; and the manner of it may be somewhat imagined
 “ by the similitude thereof: for the ray is like the string, strained between the
 “ luminous object and the eye, and the stop or fingers is like the refracting sur-
 “ face, on one side of which the string hath no motion, on the other a vi-
 “ brating one. Now we may say indeed and imagine, that the rest or straight-
 “ ness of the string is caused by the cessation of motions, or coalition of all vi-
 “ brations; and that all the vibrations are dormant in it: but yet it seems more
 “ natural to me to imagine it the other way.

“ And

“ And I am a little troubled, that this supposition should make Mr. NEWTON wholly lay aside the thoughts of improving telescopes and microscopes by refractions; since it is not improbable, but that he, that hath made so very good an improvement of telescopes by his own trials upon reflection, would, if he had prosecuted it, have done more by refraction. And that reflection is not the only way of improving telescopes, I may possibly hereafter shew some proof of. The truth is, the difficulty of removing that inconvenience of the splitting of the ray, and consequently of the effect of colours, is very great; but yet not insuperable. I have made many trials, both for telescopes and microscopes by reflection, which I have mentioned in my Micrographia, but deserted it as to telescopes, when I considered, that the focus of the spherical concave is not a point but a line, and that the rays are less true reflected to a point by a concave, than refracted by a convex; which made me seek that by refraction, which I found could not rationally be expected by reflection: nor indeed could I find any effect of it by one of six foot radius, which, about seven or eight years since, Mr. REEVE made for Mr. GREGORY, with which I made several trials; but it now appears it was for want of a good encheiridia (from which cause many good experiments have been lost) both which considerations discouraged me from attempting further that way; especially since I found the parabola much more difficult to describe, than the hyperbola or ellipsis. And I was wholly taken from the thoughts of it, by lighting on divers ways, which in theory answered all I could wish for; tho’ having much more business, I could not attend to bring them into use for telescopes; tho’ for microscopes I have for a good while used it. Thus much as to the preamble; I shall now consider the propositions themselves.

“ First then, Mr. NEWTON alledgeth, that as the rays of light differ in refrangibility, so they differ in their disposition to exhibit this or that colour: with which I do in the main agree; that is, that the ray by refraction is, as it were, split or rarified, and that the one side, namely that which is most refracted, gives a *blue*, and that which is least a *red*: the intermediate are the dilutings and intermixtures of those two, which I thus explain. The motion of light in an uniform medium, in which it is generated, is propagated by simple and uniform pulses or waves, which are at right angles with the line of direction; but falling obliquely on the refracting medium, it receives another impression or motion, which disturbs the former motion, somewhat like the vibration of a string: and that, which was before a line, now becomes a triangular superficies, in which the pulse is not propagated at right angles with its line of direction, but askew, as I have more at large explained in my Micrographia; and that, which makes excursions on the one side, impresses a compound motion on the bottom of the eye, of which we have the imagination of *red*; and that, which makes excursions on the other, causes a sensation, which we imagine a *blue*; and so of all the intermediate dilutings of those colours. Now, that the intermediate are nothing but the dilutings of those two primary, I hope I have sufficiently proved by the experiment of the two wedge-like boxes, described in my Micrographia. Upon this account I cannot assent to the latter part of

" the proposition, that colours are not qualifications of light, derived from refractions, or reflections of natural bodies, but original and connate properties, &c.

" The second proposition I wholly allow, not exactly in the sense there meant, but with my manner of expressing it; that is, that part of the split ray, which is most bent, exhibits a blue, that which is least, a red, and the middle parts midling colours; and that those parts will always exhibit those colours till the compound motions are destroyed, and reduced by other motions to one simple and uniform pulse as it was at first.

" And this will easily explain and give a reason of the phenomena of the third proposition, to which I do readily assent in all cases, except where the split ray is made by another refraction, to become intire and uniform, again to diverge and separate, which explains his fourth proposition.

" But as to the fifth, that there are an indefinite variety of primary or original colours, amongst which are yellow, green, violet, purple, orange, &c. and an infinite number of intermediate gradations, I cannot assent thereto, as supposing it wholly useless to multiply entities without necessity, since I have elsewhere shewn, that all the varieties of colours in the world may be made of two. I agree in the sixth, but cannot approve of his way of explicating the seventh. How the split ray being made doth produce a clear and uniform light, I have before shewed; that is, by being united thereby from a superficial motion, which is susceptible of two, to a lineary, which is susceptible of one only motion; and it is as easy to conceive how all those motions again appear after the rays are again split or rarified. He, that shall but a little consider the undulations on the surface of a small river of water, in a gutter, or the like, will easily see the whole manner curiously exemplified.

" The eighth proposition I cannot at all assent to, for the reasons above; and the reasons of the blue flame of brimstone, of the yellow of a candle, the green of copper, and the various colours of the stars, and other luminous bodies, I take to proceed from quite another cause, easily explained by my former hypothesis.

" I agree with the observations of the ninth, tenth, and eleventh, though not with his theory, as finding it not absolutely necessary, being as easily and naturally explained and solved by my hypothesis.

" The reason of the phenomena of my experiment, which he alledgeth, is as easily solvable by my hypothesis as by his; as are also those, which are mentioned in the thirteenth. I do not therefore see any absolute necessity to believe his theory demonstrated, since I can assure Mr. NEWTON, I cannot only solve all the phenomena of light and colours by the hypothesis I have formerly printed, and now explicate them by, but by two or three other very differing

fering from it, and from this, which he hath described in his ingenious discourse.

Nor would I be understood to have said all this against his theory, as it is an hypothesis; for I do most readily agree with them in every part thereof, and esteem it very subtil and ingenious, and capable of solving all the phenomena of colours: but I cannot think it to be the only hypothesis, nor so certain as mathematical demonstrations.

But grant his first proposition, that light is a body, and that as many colours as degrees thereof as there may be, so many sorts of bodies there may be, all which compounded together would make white; and grant further, that all luminous bodies are compounded of such substances condensed, and that whilst they shine, they do continually send out an indefinite quantity thereof, every way in orbem, which in a moment of time doth disperse itself to the utmost and most indefinite bounds of the universe; granting these, I say, I do suppose there will be no great difficulty to demonstrate all the rest of his curious theory: though yet, methinks, all the coloured bodies in the world compounded together should not make a white body, and I should be glad to see an experiment of that kind done on the other side. If my supposition be granted, that light is nothing but a simple and uniform motion, or pulse of a homogeneous and adopted (that is a transparent) medium, propagated from the luminous body in orbem, to all imaginable distances in a moment of time, and that that motion is first begun by some other kind of motion in the luminous body; such as by the dissolution of sulphureous bodies by the air, or by the working of the air, or the several component parts one upon another, in rotten wood, or putrifying fish, or by an external stroke, as in diamond, sugar, the sea-water, or two flints or crystal rubbed together; and that this motion is propagated through all bodies susceptible thereof, but is blended or mixt with other adventitious motions, generated by the obliquity of the stroke upon a refracting body; and that, so long as those motions remain distinct in the same part of the medium or propagated ray, so long they produce the same effect, but when blended by other motions, they produce other effects: and supposing, that by a direct contrary motion to the newly impressed, that adventitious one be destroyed and reduced to the first simple motion; I believe Mr. NEWTON will think it no difficult matter, by my hypothesis, to solve all the phenomena, not only of the prism, tinged liquors, and solid bodies, but of the colours of plated bodies, which seem to have the greatest difficulty. It is true, I can, in my supposition, conceive the white or uniform motion of light to be compounded of the compound motions of all the other colours, as any one strait and uniform motion may be compounded of thousands of compound motions, in the same manner as DESCARTES explicates the reason of the refraction; but I see no necessity of it. If Mr. NEWTON hath any argument, that he supposes an absolute demonstration of his theory, I should be

"very glad to be convinced by it, the phenomena of light and colours being, in my opinion, as well worthy of contemplation, as any thing else in the world."

MONS. SCHROTER presented for the repository a glass, which by a metallic body he had tinged red, so as that it differs not from the ancient red glass. He affirmed that this manner of tinging is neither difficult nor chargeable. His paper accordingly was ordered to be registred*, and was as follows:

"This red glass, made by the help of a metallic tincture, doth in its colour or else not differ from the ancient red glass, and is as good as the same, if not better: then the colour of this glass can be heightened and made darker. The manner of tinging it is not difficult, but it may be quickly prepared without great labour or danger: the charges are likewise small, so that, with a small quantity of tincture, much glass may be tinged; whether an hundred times more, or a greater quantity, I cannot well say, for that I never took notice of very accurately. As for the bigness of the glass, it is no matter of what bigness it be; for a table of glass of that colour may be made, though it be some feet long or broad, without an especial furnace or fire."

MR. HOOKE was put in mind of the six foot tube of Mr. NEWTON's invention, and of bringing in a specimen of the effect of his own proposition.

February 22. Mr. HOOKE made an experiment, to shew, that, besides the flame and smoke of a candle, there is a continual stream rising up from it, distinct from the air; concerning which, he said, that he conceived, that as the action of the air upon the parts of the candle heated, or the dissolution of them, was the flame; so the composition of the air, and the relief of the effluvia of the parts of the candle dissolved thereby, made this stream, which continually ascended, and kept itself distinct from the air.

MR. NEWTON's letter to Mr. OLDENBURG, dated at Cambridge, February 20, 167½, was read, promising an answer to Mr. HOOKE's observations upon his new theory of light and colour. It was as follows:

"I received yours February 17, and, having considered Mr. HOOKE's observations on my discourse, am glad, that so acute an objector hath said nothing that can enervate any part of it: for I am still of the same judgment, and doubt not, but that upon severer examinations, it will be found as certain a truth as I have asserted it. You shall very suddenly have an answer."

"In MONS. HUGENIUS's letter there are several handsome and ingenious remarks: and what he saith concerning the grinding parabolical comoids by geometrical rules, I do, with him, despair of; but I doubt not but that the thing may be, in some measure, accomplished by mechanical devices."

* Register, vol. iv. p. 125.

u Letter book, vol. v. p. 166.

Signor MALPIGHI's letter of 1st February, 1672, from Bologna, was read, intimating, that he had transmitted a discourse, and some schemes, concerning some late observations of his upon eggs, which he submitted to the examination and censure of the Society.

This discourse being opened, and read in part, it was found, that that philosopher had, by very careful and diligent microscopical observations, discovered that, in prolific eggs, before, as well as after, incubation, the first rudiments of the principal parts of the chick are actually contained; but that, in addle eggs, instead of such a substance, there is only found a globous, ash-coloured body, like a mola, &c. It was ordered, that this discourse, and the figures thereunto belonging, being by the author ready fitted for the press, should forthwith be committed to the printers of the Society to be printed; and that particular care should be taken by the secretary, of having the schemes exactly engraven by the best engraver to be had in London: as also that solemn thanks should be returned to the learned and obliging author for this ingenious piece, and for his singular respect to the Society.

The secretary having foreseen, that such an order would be given, and therefore drawn up provisionally, a letter for that purpose, it was ordered to be read, and being approved of, to be sent away by the first opportunity.

Mr. HOOKE was desired to produce at the next meeting the experiment of representing a blue and red colour in two wedge-like boxes.

February 29. The experiment exhibited at the last meeting, to shew the steam about the flame of a candle distinct from the smoke and air, was repeated, and proved satisfactory. Mr. HOOKE was ordered to give an account in writing of the manner of representing this experiment.

He proposed a way for a very speedy conveyance of intelligence from place to place by the sight assisted with telescopes, to be employed on high places, by the correspondents using a secret character, proportioned in bigness according to the distance at which they are to be seen, &c.

The paper of this proposition, and the particulars of the manner of practising it, were read, but not left by Mr. HOOKE to be registered, but taken away by him.

It was ordered, that some experiment should be made of this proposition at the next meeting; which Mr. HOOKE promised to do.

Signor MALPIGHI's discourse concerning his new discoveries in the egg being again mentioned, Dr. CROONE said, that he had also found some such thing as the rudiments of a chick in the egg before incubation.

* It was dated February 22, 1672, and entered in the Letter-book, vol. v. p. 167.

The bishop of Chester desired, that notwithstanding this, Signor MALPIGHI might have the honour of this discovery, since Dr. CROUNE had never brought into the Society, an account, or a figure of this discovery, as Signor MALPIGHI had now sent to them an accurate description of this discovery, accompanied with many very neat, and laborious schemes.

The bishop of Salisbury moved, that the observations of both Dr. CROUNE and Signor MALPIGHI might be printed.

Dr. CROUNE gave an account of an embryo of six weeks old, of the bigness of a bee, which, being put into spirits of wine, the spirit did so penetrate the amnion, that the colluquamentum was thereby precipitated. He promised to produce this embryo at the next meeting.

Dr. WALTER NEEDHAM communicated a letter from Mr. JOHN TEMPLER, dated at Braybrook, 8th January, 167 $\frac{1}{2}$, giving an account of a dog rendered ricketty and dwarfish by washing him in brandy; and of another young dog, who having brandy given him to drink every morning, was brought to a violent and constant asthma.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated at York, 24th February, 167 $\frac{1}{2}$, containing his sense of what Signor CORNELIO had written from Naples, about the fictitiousness of the stories recorded of the mischievous effects of the biting of tarantulas. The letter was as follows:

"As for the further account concerning the tarantula of Signor CORNELIO at Naples, I received it in Italian, as you was pleased to communicate it to me; and since you desire my thoughts upon this matter, I will briefly make some reflexions upon some of the particulars, and explain thereby the quære, that gave the occasion.

"It is here affirmed, that the tarantula is a phalangium; which yet does not plainly appear; possibly it may, when the author shall please to give us his more particular observations, or transmit any of the animals themselves. 'As he', *diversely* painted with diversity of colours, to live in holes of the earth; 'are notes great heed be taken of the characteristical notes we gave you, and by that we know phalangia from all other tribes of spiders; for in this condition (at least in my judgment) the discovery of the nature and effects of the tarantula.

"We had, undoubtedly, been in the dark still, but for that one chance note of PLINY, lib. 11. c. 24. viz. *offulsum ingredi*; and had never known what the ancients had meant by their phalangia: and yet, having observed that skipping

“ motion in two or three sorts of our English spiders, we found, that all those, which
 “ had that peculiar motion, agreed too in the senary number of eyes, not to mention
 “ other distinguishing marks; those two being enough to reduce them to order.”
 “ Now then, it being the sole property of this tribe of spiders to move in going,
 “ as though they danced, and therefore to be (for kind) those, which the antients
 “ called *phalangia*, and whose biting they so much dreaded; I thought it very
 “ material to enquire, whether the tarantula was not one of them, that is,
 “ whether the tarantulae go by skips, and have six eyes only, &c.?

“ To tell you the truth, I had some reason to question this; not but that the
 “ phenomena, or the effects of that mischievous bite, if really true, did un-
 “ doubtedly depend (in my thoughts) upon the nature of the animal; but that
 “ I had seen the spider brought from Rome, by the name of tarantula, and yet
 “ whose figure, as I remember, shewed it plainly to be of another tribe, and no
 “ phalangium. Again, because some late authors, that I had seen of this matter,
 “ had given us the cut, or figure, of a *reticulum orbiculatum*, or wheel-net, with
 “ a tarantula in it, which, in truth, is as an improper a thing (if a phalangium) as

“ Delphinium Sylvis appingere ———

“ this tribe having that in common with some other tribes of spiders, that they
 “ scorn nets, and hunt openly, and take their prey by ambush and agility of
 “ body. For an elegant description of their hunting, I refer you to Mr. EVELYN
 “ in Mr. Hooke's *Micrographia*; where also I observe to you, by the by, that
 “ that grey phalangium, there mentioned, is exceeding common all over England
 “ (where I have been) as well as at Rome.

“ We may well expect, from the ingenuity and diligence of Signor CORNELIO,
 “ the full clearing of this matter; we being already beholden to him for that
 “ other rarity of his native soil, *manna*, which he hath put beyond exception, to
 “ be a spontaneous exudation of the ash tree. See the experiment registered, as
 “ he himself penned it, in a letter to Mr. WRAY, *Catalog. Plant. Angl. in*
 “ *Fraxine*. However, in the mean time, I may deserve your pardon, if I pre-
 “ possess you with my opinion. I agree with him, that the matter will probably,
 “ when thoroughly examined, not prove, not only as the vulgar is persuaded,
 “ but not as authors write neither: and yet, he must excuse me, if I think it
 “ will prove more than a meer fiction, and that those strange accidents, which
 “ the *atterantati* are said to suffer, are not to be attributed to the great drought
 “ of the country and thirst only, but possibly to the bite of a certain animal too.”

March 7. An experiment was made of the method proposed by Mr. Hooke
 at the last meeting, of conveying intelligence from place to place, which was
 performed from Arundel-house garden to a boat lying near the shore on the
 other side of the Thames, by letters of a foot long, and glasses of two feet long,
 the distance being about half a mile.

The

The contrivance was applauded as very ingenious, and the author desired to make more trials of it at greater distances.

The president objected, that the use of it would be often hindered by hazy weather.

Others intimated, that the greatest difficulty in the practice would be in proportioning the glass and the letters, viz. at what distance a glass of such or such a length shall discover characters of such and such a bigness.

Dr. KING produced some galls of oak, seeming to him to be a fruit: but many of the members thought them to be excrescences caused by insects.

Sir ROBERT MORAY mentioned, that a whole kennel of dogs belonging to his Royal Highness the Duke of York, which had been bitten by a mad dog, were lately cured by a certain herb, called *stellaria*, or the star of the earth.

Mr. OLDENBURG produced a paper, importing, that Mons. PECQUET had lately made a new discovery between the *ductus thoracicus* and the inferior *vena cava*, which was ordered to be read at the next meeting.

Mr. HOOKE promised to shew at the next meeting something having neither reflexion nor refraction, and yet diaphanous.

March 14.

Dr. TILLOTSON was admitted fellow.

Mr. COCK was ordered to make, for the use of the society, a telescope of Mr. NEWTON's invention, of the length of four or five feet; which he promised to have ready within a fortnight.

He being put in mind of making a large burning concave, was advised to contract with the founder for one of a certain size, at a certain price, on condition of its being without fault: which he promised likewise to endeavour to do.

Mr. HOOKE brought in an account of an experiment shewn before the society, February 29, and designed to prove, that the substance of a candle, or lamp, is dissolved by the air, and the greatest part thereof reduced to a fluid of the form of air. This paper was ordered to be registered*, and was as follows:

"I took a large concave reflecting glass, or a large convex refracting glass, and so placed it in respect to my eye, that a candle set at a certain distance beyond the reflecting glass, or between the eye and the superficies of the reflecting glass, enlightened the whole area of the said glasses in respect to the eye. Then continuing to keep the eye in that place, where the area of the said

* Register, vol. iv. p. 126.

" glasses

" glasses appeared to be wholly filled with the flame of the candle, I caused another
 " candle to be placed very near the said glasses, between the eye and the glass;
 " or beyond also, if I made use of the refracting glass. Then looking steadfastly
 " at the flame of this last candle, it was very plain to be perceived, that the
 " flame thereof was encompassed with a stream of liquor, which seemed to issue
 " out of the wick, and to ascend up in a continual current, or *jet d'eau*, to keep
 " itself intire, and unmixt with the antient air, notwithstanding that it was a
 " considerable way carried above the aforesaid flame. It was further very plain,
 " that the said distinct fluid did make several turnings, whirlings, or vortices in the
 " ambient air, as it ascended higher and higher, and by degrees mixed itself with
 " the ambient air. It was yet further observable, that the shining flame was
 " placed in the middle of this *jet d'eau*, at the lower end thereof; but that it
 " did not ascend proportionally in height to the height of the jet d'eau; that,
 " where the tip of the flame ended, there ascended up a small line, of an opaque
 " body, or smoke, which, to a good height above the flame, kept the middle
 " of the stream. The manifestation of this phenomena was from the differing
 " refractions of the body of the jet d'eau from that of the ambient air: for the
 " flame of the first candle being but small, and placed at a considerable distance
 " from the refracting, or reflecting glass, the smallest variation in the refraction
 " of the medium between the first glass and the eye caused the darkness to inter-
 " mix with the light; so to exhibit the appearance of the heterogeneous jet d'eau.
 " This jet d'eau I suppose to be nothing else but the mixture of the air with the
 " parts of the candle, which are dissolved into it in the flame; for the air being
 " (as I have elsewhere proved) the universal menstruum, or dissolvent, of all
 " sulphurous bodies, and the action of dissolution in most bodies producing heat
 " and light; it is manifest by the flame, that there is such a solution, and it is
 " not probable that the body so intermixt, should immediately so perfectly in-
 " termix itself with the rest of the air, as not to appear, for a time, distinct
 " from it, though it doth afterwards intermix itself with the rest of the air.
 " The reasons why this mixt body (which certainly is otherwise heavier than
 " the air, and so ought to descend) doth, notwithstanding, ascend with great
 " swiftness, is first, from the ascent of the flame in the middle; and next, from
 " the extraordinary rarefaction of the same, by the same nearness and centrality
 " of the flame and heat; whereby it is made much lighter than the ambient
 " air. A phenomenon not much unlike this may be produced by several bodies
 " dissolved in oil of vitriol, wherein all the appearances, but light, are very
 " perfectly represented."

Mr. Hooke promised to exhibit at the next meeting, an experiment to shew a
 phenomenon not unlike this, to be produced by several bodies dissolved in oil
 of vitriol.

He shewed a phenomenon in a bubble raised by water and soap, wherein
 there appeared something on water which had neither reflection nor refraction,
 and yet was diaphanous. He was desired to bring an account of this in writing,
 with his thoughts upon it.

Dr. CROWE produced the little fetus of six weeks old in spirit of wine, mentioned by him at the meeting of February 29; and it appeared, as if the spirit had penetrated the bag of this fetus, and precipitated the colluquamentum thereof to the bottom of the bag.

He likewise gave in his Latin discourse concerning the conformation of a chicken in the egg; which was ordered to be read at the next meeting, being too long to be read at the present.

Mr. OLDENBURG read the letter from Paris, produced by him at the preceding meeting, concerning a discovery lately made there by Monf. PECQUET, of a communication between the *ductus thoracicus* and the inferior *vena cava*.*

March 21. There was read a letter of Mr. HEVELIUS to Mr. OLDENBURG, dated at Dantzick, 9th March, 1672; giving notice of a comet observed by him in Andromeda for several days, mornings and evenings, ever since the 2d of March; and mentioning that he had again seen the new star under the head of the constellation of the Swan.

This letter having been communicated to Mr. HOOKE some days before this meeting, he said, that he had not hitherto discovered any comet.

It was ordered, that notice should be given of this phenomenon by the secretary, to some persons in both the universities for observation, and particularly to Dr. WALLIS and Mr. NEWTON.

There was read a letter of Mr. NEWTON to Mr. OLDENBURG, dated at Cambridge, March 19, 1672; containing several particulars relating to his new telescope.

Mr. BOYLE communicated a paper of his, containing an account of nineteen observations made by himself on shining flesh, both veal and pullet, especially the former, in one piece of which he had reckoned distinctly above twenty several places, which all shone, more or less, without finding by the smell the least degree of stink, whence to infer any putrefaction; which observations were ordered to be registred†.

This paper occasioned some discourse concerning observations made by others of the like phenomena, not only in flesh, as in lamb-flesh, mentioned by FABRICIUS AN AQUAPENDENTE, but also in oysters, the sea-water, &c.

* This paper was probably that printed in the *Journal des Sçavans* of Feb. 8. 1672. See Phil. of Transact. vol. vii. n° 85. p. 5077.
† Letter. book, vol. v. p. 182. It is published in the Philof. Transact. vol. vii. n° 81. p. 4017.

4 It is printed in the Philof. Transact. n° 81. p. 4009.

* Register, vol. iv. p. 130. They are printed in the Philof. Transact. vol. vii. n° 29. p. 5108. for December, 1672.

March

March 28, 1672. There were read the answers given in by the lord HENRY HOWARD of Norfolk, to the inquiries concerning Barbary, formerly recommended by the Society to his lordship, when he went ambassador from the king to the emperor of Morocco.

After this paper was read, his lordship declared to the Society, that he went not himself, for reasons known, to Morocco; but that an ingenious person, one of his attendants in his voyage, Mr. BURGHILL, took care, by his order, to inform himself as well as he could, about the particulars contained in these inquiries; of which this was the result, which he desired the Society to accept of.

The Society returned to his lordship many thanks for his great favour and care of their concerns; and ordered, that this account should be entered in their Register-book: as also, that Mr. BURGHILL should, in their name, be thanked by the secretary for his respect to the Society, in complying so carefully with their desires.

This paper was as follows:

“ Q. 1. What is the temperature of the air ?

“ A. It is so hot in the latter end of August, that it melted chocolate-cake, and refin of jalap; the latter being dried and grossly powdered. And the air is withal so gross and hazy, that the sun never shined out, whilst we were there, before nine in the morning, or after four in the evening, unless there had been a brisk gale of wind the day before.

“ Q. 2. What diseases the inhabitants are most subject to ?

“ A. Fevers, (which they call calentures one with another) fluxes, and some of them with blood, the king's-evil, the pox, and films over their eyes, both very frequent.

“ Q. 3. Whether it be true, that those in Numidia, in the land of Dates, live long, though they lose their teeth soon; and that the negroes are short-lived, though their teeth continue sound to their death ?

“ A. Long in the hilly parts, the air being better there; yet they lose their teeth by times, perhaps caused by the sharp sweetish juice of new dates, the greatest part of their food; but they are shorter lived in the vallies, where the air is gross and very suffocating in hot weather.

“ Q. 4. Whether the venereal disease be seldom found in Numidia and Lybia ?

“ A. A distemper well known over all Barbary:

† Vol. iv. p. 174.

“ Q. 5.

" Q. 5. Whether in Barbary the plague is every tenth or fifteenth year, and in Numidia not once in a hundred years, and in the land of the negroes not known at all?

" A. Not known there at all.

" Q. 6. What medicines they use, and what poisons and antidotes are known amongst them? Whether granum Nubiæ will kill in a lesser quantity than any other known poison? Whether they have any poison, that kills by smell alone; and if so, what that is?

" A. Athena they esteem an universal medicine for man and beast; if it fail, they cauterize both, as our farriers do horses for the farcy. They have several poisons that kill, but not by the smelling to them. Granum Nubiæ is not known at Morocco.

" Q. 7. What is the composition called lhaithif, of which it is said, that whoever takes an ounce of it, shall fall a laughing and sporting, and be like one half-drunk, and be never amorous?

" A. Lhaithif is the tops of green hemp, made with honey into an electuary, but not above half an ounce at one time to be taken?

" Q. 8. What kind of root it is they call tanzargent, said to be an excellent and lasting perfume?

" A. They have no perfume except musk and civet, and that very rare.

" Q. 9. What are the variations of the weather, according to the season of the year, and the times of the day; what meteors the country is most wont to breed, especially what winds it is subject to; whether any of them be stated and ordinary; whether in October and November there be such snows betwixt Mauritania and Numidia, that carts, horses, and trees are covered therewith?

" A. The rain happens most commonly in December and January. There are very great winds and thunder; sometimes they have rain in October, which causes great plenty that year, and sometimes they have no rain for three years together, which want of rain is the constant forerunner of dearth, and of locusts in such an abundance, that they devour whatever is green, which being eaten by the people, brings a mortality not unlike the plague. In summer very strong heats with winds (much hotter than sun-beams) which blow up the dust after the manner of those spouts often seen at sea; hail many times of a prodigious bigness; falling stars in greater numbers than in Europe. Levants only, which blow sometimes so far into the continent as Morocco.

" Q. 10

“ Q. 10. What observables there are concerning Mount Atlas ; what is its height ; whether it runs north and south, east or west ; what mines it affords ; whether it has any springs upon the highest parts ; whether it be true, that there are some springs adjoining Mount Atlas so cold, that if one’s hands be any while continued therein, they are in danger of gangrening ; what plants are upon and about it, and whether any cockle-shells are found upon it ?

“ A. The Lesser Atlas, when it comes near Morocco, seems more inclining to a circle than a right line ; and runs rather north and south, than any other points of the compass : the top continually covered with snow, which for the most part appears above the clouds ; many springs : but whether it be so cold on the top of the hill, I know not.

“ Q. 11. What is the nature of the soil, what grains, fruits, and other vegetables, particularly what trees, whose wood is considerable, the country affords ; to bring over some of the plants and seeds peculiar to that country ?

“ A. Fruitful, beyond belief ; of colours various, but for the most part inclining to red ; the soil extraordinary deep, and free from stones, unless it be where it is altogether rocky. The sorts of grains are barley, wheat, Indian wheat, both white and red ; another sort of grain they call tuff-foot, the stalks as big as a cane, and higher than a man on horseback, the seed about the shape of a kidney, white and big, as a black-cockle growing in corn, with which they feed cattle. There are also grapes, almonds, olives, pomegranates, oranges, lemons, dates, very great figs, citrons, all plentiful and large, except the olives and almonds, which are small, but very good : moreover, peaches, apples, and pears, which they keep as we do medlars, till they are rotten ; water-melons, both white and red, musk-melons, some whereof keep all the winter, all very large ; cucumbers of a great length, and crooked like a hunter’s horn ; calibash both white and yellow, coloquintida, and a purple fruit like a small pumpkin ; and pumpions, called bern-hena, of taste, when boiled, not unlike a Jerusalem artichock, which they boil with their meat ; wild dates, that grow like our fern, all over the country, being the leaf of which the flag-brooms are made, bearing a fruit of a kind of deep orange colour, of the bigness of a small green walnut, growing in bunches near the root, of a bitterish taste, and much eaten by the Moors in their journeys.

“ The vegetables being too many to be observed in a speedy journey, are promised to be supplied by Mr. BATAM. There is cork, oak, and cedar, of a pleasing smell ; a tree called lizr, not unlike our fir in the grain, smelling somewhat like cypress ; tamaresk, growing commonly about the rivers in great quantities.

“ Q. 12. What minerals the country is stored with ; what quarries it affords, and how the beds of stone lye ; what clays and earths it yields ; whether any
“ medicated

"medicated earths; what ways they have of reducing their ores into metals; to bring over a specimen of their ores, earths, clays, &c.

"A. There is copper, iron, lead, tin, white marble in great quantity; a kind of whetstone between rag-stone and oil-stone rock; a small sandy stone, both red and white; a kind of talc, very large; a black sparkling stone, that they make mill-stones of; (the beds whereof lie nearest north and south) blue and red clay; and a kind of fullers earth, wherewith the Moorish women wash themselves; no medicated earth. They reduce their ores into metal by charcoal.

"Q. 13. What is observable in their rivers; whether they carry any golden sand in them; what is the quality of their waters; what kind of fish they breed; their store, bigness, goodness, haunts, seasons, &c. Whether the rivers running from Atlas upon the Lybian sands are dried up in their passage; and whether the Numidian rivers be dry when no rain falls from Atlas?

"A. There are no gold sands on this side Atlas; the rivers flow, rapid, rocky, and deep; the water very heavy toward Fez. Fishes are mussels, a kind of salmon, tortoise, and divers other small fish, very well tasted, but differing from those of Europe: we were not so far as Lybia; no gold sands here, but what comes from Gambo.

"Q. 14. What lakes ponds, springs, and especially mineral waters there are; their kinds, qualities, virtues, and how examined?

"A. No lakes, ponds only artificial in great mens gardens; there is one very great and salt water between Saphy and Morocco, which being dried up every year by the sun furnishes that part of the country plentifully with salt: between Fez and Aliazar there are several springs, making divers small brooks, of salt water, crusted on the sides with white salt, in places where the sun hath power, and rising out of salt rocks, of brownish and white mixture, in veins, sharper than bay salt, and very heavy. One day's journey from Aliazar towards Fez, is a spring of green water, stinking like the pumping of a stench ship, the stream crusted with a salt green, as common copperas, towards the head of the spring, issuing out from the north side of a high hill. Their virtues neither known nor looked after by these poor, lazy, and ignorant people.

"Q. 15. What animals the country is stored with, both wild and tame; what beasts of prey they have, and the manner of catching them; what dogs they have, and what games they are inclined to?

"A. There are lions, leopards, tigers, wild boars, jackals, foxes, a beast not unlike a lion in shape, but less, and cowardly, digging men and women, as the Moors tell, out of their graves, antelopes, apes, porcupines, very large snakes, adders, chameleons, lizzards very great ones, ostriches, eagles, vultures, &c. "Rorks,

“ storks, bustards, cranes, falcons, kites, daws, pigeons, ringdoves, a sort of
 “ pigeons that stretch so exceedingly, that they are ready to fall backwards, and
 “ some eat their meat behind them; Guinea-hens, partridges, heath-cocks,
 “ ducks, curlews, teal, ox-eyes, larks, sparrows, swallows, ravens, magpies;
 “ but few camels, eromedaries, horses, mules, asses, sheep, and goats, which
 “ they sometimes shoot, and sometimes hunt with curs and greyhounds with long
 “ curled ears like spannels, and sometimes ride them down. They play at chess
 “ and draughts.

“ Q. 16. Whether it be true, that the lions about Pietra Rossa are so tame
 “ as to go into the streets and gather bones; and at Agla the lions so cowardly,
 “ that they lie at the voice of a child?

“ A. I can give no account of lions in these places in particular; but generally,
 “ the lions of Barbary are very great and fierce, coming often into the
 “ streets of towns seeking for prey, which they never do upon any dead body.

“ Q. 17. Whether camels will travel many days without provinder and drink,
 “ and ordinarily in travelling have no drink allowed them but once in three or
 “ four days; and whether the camel called Ragnahill will travel 920 miles in
 “ eight days; what manner of breeding their horses?

“ A. The camels upon necessity will travel three days without meat or water:
 “ they ride horses at a year old, handling them from their foaling; they tie them
 “ by the forelegs with cords staked down; they bring them water but once a
 “ day; their common food is straw and barley; they teach them to start, from
 “ standing stock still, in a full career; they suffer them not to trot, but walk
 “ very fast, and stop suddenly, which they do with tossing up their heads in the
 “ air. Towards Fez, where the best and fleetest are, it is said they feed them
 “ only with milk, either of goat, ass, cow, or camel. The breeding mares go
 “ about with great about their necks, and are brought by night into
 “ the d'warrs.

“ Q. 18. Whether it be true, that there is such a bird, that picks out the
 “ worm from the crocodiles teeth, which having a little sting in its head, causeth
 “ the crocodile, when he would swallow it, to open his mouth and let it escape?

“ A. No crocodiles in this part of Africa.

“ Q. 19. Whether the dubb, a creature like a lizzard, about a cubit long,
 “ and four inches broad, drinks no water at all, but dies, if water be poured into
 “ his mouth?

“ A. No such beast as a dubb, only large lizzards, being in great plains,
 “ where there was no water to be seen in many leagues of them; but we know
 “ not whether they will die with water poured into their mouths.

“ Q. 20.

“ Q. 20. Whether the chameleon dropping a slime on serpents heads kills them ? ”

“ A. We could hear of no such thing.

“ Q. 21. What the ostrich feeds upon ? To get one dried.

“ A. Beans principally, and any sort of grain, flesh, if given them, and bread; they will swallow iron: they are rarities at Morrocco and Fez, brought for presents to the king only.

“ Q. 22. As to the inhabitants, men and women, what are their inclinations, diet, œconomy, conveniencies of life, their strength, agility, and stature, shape ?

“ Not answered.

“ Q. 23. What is their way of educating their children ?

“ Q. 24. What arts, practices, and studies they are given to; particularly, what varnishes they have amongst them; and what ways of tempering their iron and steel they use ?

“ A. The best are brought up to read and write, and some to understand their laws, out of which they chuse their priests and justices; the rest illiterate and idle, until fit for the plow or wars: they use no arts at all, few of them understand, or practise any trade, but leave them lazily to the Jews, that are worse than their slaves. Varnishes they have none. They temper Spanish steel after our manner, but not so well; and for Damasco steel, they understand it not at all; nor can they harden iron, that we could ever learn.

“ Q. 25. Whether at Morrocco they keep still their public arts of scholars; and if so, what is therein performed ?

“ A. Their academies are but their priests teaching to read and write their own language and law; those places they call universities being guilty of no other learning.

“ Q. 26. Whether they have chemists among them; and if so, what are their abilities ?

“ A. None at all, but Jews, and Christian slaves, that distil brandy in jars.

“ Q. 27. Whether any African writers give any account of the antient Punic learning; and what books of geography, genealogy, history, alchemy, medicine, magic, &c. are extant amongst them; and, particularly, whether

“ the Genealogies, said by Leo Africanus to have been written by one Ivan Racha, or Rachiock, and the Cosmography of one Bichri, mentioned by the same author, are to be had; and whether one Margian, and another Jona Caldin, have written strange books concerning magick; and whether it be true what the same Leo Africanus relates, that the fortune-tellers at Fez, by pouring some drops of oil into a glass of water, can represent creatures, and shew them to by-standers, and speaking to them, do receive answers by words or signs?

“ A. We can learn of no public libraries, or of bookfellers; what are, remain in private hands, and these are historical MSS. that we could ever learn of. They use no fortune-telling, but by a kind of necromancy they pretend to procure love or hatred.

“ Q. 28. Whether there be any inscriptions, or coins with characters, neither Latin nor Arabic; and what coins, or rather inscriptions are, or have been found about Fez, and at Denfen; whether at Thelessa there be many marble pillars with sentences and epigrams in Latin characters.

“ A. We could hear of none, but at Fez have been found Roman coins long ago. We never heard of Thelessa.

“ Q. 29. To inquire into any antient manuscript, that may possib'y have been translated out of the ancient Greek, either in geometry, astronomy, physick, or chemistry.

“ A. We could never get information of any such.

“ Q. 30. What manner of architecture they use? To make some designs of their palaces and temples.

“ A. Their buildings are generally mud-wall, about two feet thick, the roof of the same, supported with small rafters, and these covered sometimes with boards, sometimes with canes, to sustain the clay, without any other ceiling. The houses never exceed two stories, even in their cities; flat on the roof, to walk on; the best built, for the most part, about a square court; the rooms about 30 feet long, between 8 or 9 feet over, 12 or 14 feet high; having seldom any windows, or lights, but what comes in by the doors, that are placed in the middle of each room, of 6 feet broad almost, to the roof, opening with two leaves towards the court; the upper rooms, as these, only opening to a narrow gallery, that goes round, supported with disorderly, extravagant pillars, made, when at best, of a whitish brick of near two inches thick, and clay between every brick, thicker than the bricks, with which they turn the arches of their doors, and intervals of their pillars. Their churches are, for the most part, built of clay, some of stone, very low, with flat roofs, paved

"paved with green tiles, as the houses with divers colours. The steeples for the most part like ours, but built of mud, except which are of square stone."

Mr. Hooke brought in his written account of an experiment, made March 13, upon a bubble of water and soap, which was ordered to be registered[†], and was as follows :

"By the help of a small glass-pipe there were blown several small bubbles out of a mixture of soap and water; where it was obvious to observe, that at the beginning to blow any of these bubbles, the orbicular film of water, which encompassed a globe of air, appeared white and clear, without any appearance of colour; but after some time the film by degrees growing thinner, (part thereof falling down, and part thereof evaporating and wasting into air) there appeared upon the surface thereof all variety of colours, that may be observed in a rainbow, beginning at first with a pale yellow, then orange, red, purple, blue, green, and so onward, with other the same series or successions of colours : in which it was farther notable, that the first and last series of colours were very faint, and that the middlemost order or series was very bright and oriental. After these colours had passed over their several changes, the film of the bubble began to appear again white, and presently up and down in this second white film there appear several holes, which by degrees increase and grow bigger, and several of them break into one another, till at length they become very conspicuous and big. It is strange to observe, how those holes will, by the blowing or moving of the ambient air, be carried up and down upon the encompassed globe of air, and yet the bubble remain in its orbicular form without falling. It is yet further strange, that after this, when the bubble breaks, its breaking is with a kind of impetus or crack, dispersing the parts in a kind of powder or mist. It is yet further strange, that those parts of the bubble, which thus appear like holes through it, by the moving up and down upon the surface of the aerial globe will change its form, and from a circular be made elliptical, or any other undulated or waved form, in the same manner as any of the colours, that are visible on the bubble. It is yet more strange, that though it is most certain, that both the encompassing and encompassed air have surfaces, yet by no means, that I have yet made use of, will they afford either reflection or refraction, which all the other parts of the encompassed air do. It is pretty hard to imagine, what curious net or invisible body it is, that should keep the form of the bubble, or what kind of magnetism it is, that should keep the film of water from falling down, or the parts of included and including air from uniting. The experiment, though at first thought it may seem one of the most trivial in nature, yet as to the finding out the nature and cause of reflection, refraction, colours, congruity and incongruity, and several other properties of nature, I look upon it as one of the most instructive : of which more hereafter perhaps."

[†] Vol. iv. p. 128.

He made an experiment of dissolving sal-nitre in common water, whereby was caused a stream composed of water and of the particles of nitre dissolved therein; which stream was here descending, as in a former experiment a stream of fluid produced by a candle dissolved by the air ascended.

He was desired to bring in the description of it in writing.

There was read a letter of Mr. NEWTON to Mr. OLDENBURG, dated at Cambridge, 26th March, 1672^a, containing some more particulars relating to his new telescope, especially the proportions of the apertures, and charges for several lengths of that sort of telescope.

Mr. OLDENBURG communicated a relation, lately printed at Paris, concerning the return of a great permanent spot in the planet Jupiter^b, making its periodical revolution with the greatest regularity and swiftness hitherto known in the heavens; viz. in nine hours and fifty six minutes, observed by Signor CASSINI.

It was looked upon as a remark of considerable importance though it was at the same time taken notice of, that the same spot had been discovered by Mr. HOOKE in May 1664, before any thing was heard of it from abroad, as appeared from the Philosophical Transactions, vol. i. part 1. p. 3. compared with n^o 4. p. 78. n^o 8. p. 143. n^o 12. p. 209. and n^o 15. p. 246.

It was thought very desirable, that Signor CASSINI would communicate to the curious a table of this motion for a whole year, which might serve for observations in several distant places in the world. As also, that he would signify of what length the telescope was, which he employed in these observations.

There was read part of Dr. CROWE's Latin paper, *De Formatione Pulli in Ovo*, agreeable to that of Signor MALPIGHI, lately sent to the Society, importing chiefly, that the rudiments of a chick are actually existent in the fecundated egg, even before incubation.

The whole paper was as follows^c:

“ Cum aliquando de ortu animalium aliud, ut fit, ex alio cogitarem, venit in
 “ mentem experiri ea, quæ Cl. Harveus hac super re scripto immortalis in lucem
 “ edidisset. Non vero, ac si quæ vir iste prope divinus scripserat, aut recta non
 “ effe, aut non satis accurate expensa vel minimum suspicarer, sed ut ipsa dun-
 “ taxat eorum, quæ tradiderat, ~~etiam~~ animus oblectarem. Quoniam autem
 “ mihi per id tempus in rus quoddam suburbanum sepe commigrandum fuit,
 “ usus sum loci opportunitate, ad hanc rem maxime idonea; erat namque in vicina
 “ paupercula quadam, quæ magnum gallinarum numerum ad quæstum, sive

^a Letter book, vol. v. p. 187. It is printed in the Philosophical Transactions, vol. vii. n^o 82. p. 4032, for April, 1672.

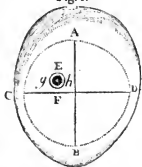
^b It is printed ibid. p. 4037.
^c Regiller, vol. iv. p. 157.

“ ex ovis, five ex pullis faciendum, alebat: illa mihi ova omnis generis, tam
 “ recens exclusa, quam ad dies quot volueram incubata, levi pretio obtulit.
 “ Quæ dum inspicio, summamque naturæ sapientiam, in exigua ista ovi mole
 “ omnium animantium primordia collocantem, admiror, nata est mihi observa-
 “ tio quædam maximi, in hoc negotio momenti, quæ non
 “ solum diligentissimum naturæ indagatorem Harveyum, sed et alios, quos hac-
 “ tenus viderim, omnes penitus effugit. Ex qua profecto constabit, eam esse
 “ naturæ in divino hoc opere subtilitatem, ut serio nobis putandum sit, unum
 “ hoc omnium esse, cujus perfectam cognitionem aut nusquam certe aut tar-
 “ distissime consequamur. Observationem autem ipsam, quemadmodum a me facta
 “ est, bona fide sic enarrare aggredior.

OBSERVATIO I.

“ Mulier itaque ista, quam dixi, cum forte ex importuno gallinæ strepitu eam
 “ ovum jam tum enixam esse comperisset, illud continuo ad me attulit; quippe
 “ paulo ante monueram, velle me ovum inspicere, cui gallina nondum incubisset.
 “ Accepto ovo, alteram quidem corticis partem secundum longiorem diametrum
 “ abstuli^a, quo, liberius effuso fere omni albumine, vitellum & in eo cicatriculam
 “ contemplari possem. Erat quidem hujusce cicatriculæ diam. $\frac{1}{4}$ fere totius
 “ transverse ovæ diametri. Quod ideo annotare visum est, quia magnitudo ejus
 “ non tam ab ipsa ovi magnitudine, quam a viribus ejusdem ac vegeto intus
 “ calore provenire videtur: Namque memini, videre me in ovo anserino (quod
 “ tamen alijs de causis infæcundum fuisse conjiciebam) cicatriculam multo mino-
 “ rem quam quæ in omni ovo gallinæ fere cernitur: imo hoc etiam vel ex eo
 “ patet, quod quo longiori incubatu ovum sovetur, eo latior fit hæc macula atque
 “ amplior. Circulus præterea cicatriculæ hujus, five limbus exterior albicans
 “ E.g.F.b in fig.1. summe aquabiliserat, exquisitæque
 “ ut ita dicam, tornatus: id quod etiam argumento
 “ est, ovum hoc robustum fuisse, naturæque in eo
 “ opus rite hucusque et alacriter processisse. Sequenti
 “ etenim die aliud recentissime quoque exclusum
 “ aperui, in quo cicatricula ejusdem profecto dia-
 “ metri erat; limbus autem iste exterior laciniatus
 “ omnino ac male concinnatus. Quinetiam et illa,
 “ quæ in centro hujus circuli veluti nebula quædam
 “ obscure albescens semper visitur, in ovo illo priori
 “ superficiei ambitum æqualiter undique termina-
 “ tum, in hoc autem asperum et interruptum obtri-
 “ nuit. Hæc quidem omnia in antecessum observasse
 “ multum ex usu erit; ut statim, vel ex ipso Harveyo
 “ liquebit. Ad ovum itaque illud primum ut
 “ redeam; cum cicatriculam hanc aliquandiu conspexissem, imo et microscopium
 “ affabre elaboratum (quod rum forte ad manum erat) ad partes vocassem, ne

Fig. I.

^a Vid. Fig. I.^a limbus

hilum tamen proficere me sensi, nec quicquam ipsius ope oculis oblatum esse, quod absque illo, hec forma minori, discernere nequibam. Equidem, ut verum fatear, nimum vellem aliquid vidisse, quod conceptam jampridem apud me sententiam de instantanea animalium per metamorphosin (ut loquuntur) productione confirmare posset. Legeram ante biennium quæ in hanc rem attulerat vir doctiss., Antonius Everhardus: Ac, ut nihil dissimulem, ex iis, quæ ipse ex Harveo, p. 75. adduxit, primo mihi ansa suspicandi data est, aliquando aliquid in ovo repertum iri, quod hujus sententiæ claram omnibus fidem faceret. Veruntamen, ut initio dixi, tam parum mihi spei restabat (quod olim repetitis sæpe plurimis experimentis frustra fuisset) ut cum primum ad ovum hoc inspiciendum accessi, nihil minus quam hac de re cogitarem. Ut pergam vero; cum nescio quid aliud acturo, ovum e manibus deponere necessum esset, illud non longe a foco collocavi, utique ut blandum duntaxat calorem inde acciperet; verbar enim, ne tempestas paulo inclementior (erat enim circa initium Martii hujus anni) efficeret, quo minus pulsationem seu motum aliquem in cicatrice tam pulchra animadvertere potuerim: cum ecce paulo post rediens, video eam vitelli partem detumuisse, quæ cicatriculæ erat propinqua, foveamque adeo in ipso factam, quæ pisi majoris hemisphærium recipere posset. Ipsa quoque cicatrix penitus offuscata erat; foveæ vero hujus margo, aliæque circum partes ipsi vicinæ, jam ad latitudinem fere semiuncie undique indurescere cœperant; quas quidem omnes facile a reliquo vitello forfice sejunxi; ipsum autem vitellum cum albumine paulo ante effuso famulæ ad usus domesticos servandum tradidi. Doluit vero, tam prope foco ovum admovisse, et pulchellam hanc cicatriculam ita temere corrupisse. Forte tum accidit, ut vasculum aliquod aquæ tepidæ non procul esset; dumque hac animo versantur, particulam illam quam dixi vitelli calore ignis incrustatam et a forfice adhuc pedentem, nescio quo modo in id conjicio: ubi dum subinde agito, abscellit a lutei parte dura cuticula tenuissimæ nebulæ instar, eaque: subsidente luteo, natabat; hanc dum se in aqua varie explicantem atque evolventem proprius intueor, animadverti primo ipsam fibrillis fere innumeris, venularum in modum, undique scatere, sacculumque prorsus referre: post autem crassiculum nescio quid subtus latere videbatur, ac membranulam hanc valde tenuem et subtilem pondere suo deorsum ferre. Adhærebant quidem alteri ejus extremitati, quam propterea forfice leniter sustuli, ut quid tandem esset explorarem. Interea rem curiosius spectans visus sum mihi videre aliquid capiti scæus pullive per simile; quod certe non difficulter agnovi, quia anno superiori in ovis jam triduum vel quadriduum incubatis scæus hujusmodi, sed paulo provectiores, sæpius vidissem: quorum unus aut alter in ampulla vitrea spiritus vini plena jam tum apud me erant: hinc avidis oculis totum quicquid est perlustro, ac clare admodum distincteque bullulas istas duas grandiores, quæ oculi quidem sunt, cum rostro interjacente, conspexi; costulas præterea coloris lactei, et prominula pedum rudimenta. Extabant etiam velut e ventre bina quidem filamenta non valde exilia, in extremis laciniata, ac si alicunde abrupta fuissent; hæc autem vasa umbilicalia esse ex sequente observatione constabit. Quæ cum ipse paululum seorsim considerassem, instantibus quoque monstravi, e quibus erant nonnulli, qui scetus, quos

" comme.

“ commemorini, priores vidissent. Caterum membranam hanc delicatissimam cum
 “ appenso ipsi fœtu, ea qua cernebatur magnitudine, rudi hac figura utcumque ex-
 “ pressi, quod nisi statim fecissem, perisset mihi bona pars observationis hujus: nam
 “ cum ipsam in $\frac{1}{2}$ (ubi etiamnum adservo) indidissem, ut in eo per otium diutius
 “ et magis particulatim singula contempler, dictu citius et pellicula ista ac simul
 “ fœtus crassescere et albescere cœperunt, speciemque ovi albuminis, diutius in
 “ aqua cocti, præ se ferre; unde omnia momento mutata minus distincte explica-
 “ cateque apparuere. Fig. hæc est S S S mem-
 “ branulam exhibent; $o p$ duas bullulas, q ros-
 “ trum, $d d$ costulas lacteas, r pedis rudimen-
 “ tum; $c c$ vasa umbilicalia. Monendum est
 “ autem, ut observatio hæc rite fiat, et ex
 “ voto succedat, ovum requiri robustum ac
 “ valido calore intus præditum, cujusque cicat-
 “ ricula latior, & circuli æquabiliter circun-
 “ nati sint; aliter enim (nisi summe etiam ca-
 “ veas dum res administratur) tenellula pulli
 “ corporatura facile diffluit et cum vitello
 “ permiscetur. Equidem haud potui mihi ipsi non gratulari, quod forte primus
 “ pullum in ovo, non dico, antequam punctum illud saliens HARVEI appareat,
 “ sed etiam priusquam ei gallina omnino incubuisset (aut saltem minima temporis
 “ morula) viderim. Profecto HARVEUS ovum primi circiter quadridui incubatu
 “ ad fœtum ait præparati; istum vero fœtum jam ante in ovo sub cicatricula
 “ (ut post patebit) latentem extitisse, hoc ipsi minime perspectum fuit.

Fig. II.



OBSERVATIO II.

“ Ac de prima hac observatione nostra, præcipua quidem ea, &, si ita loqui
 “ liceat, fundamentali, tantum est: ad secundam venio, quam idcirco attexere
 “ volui, ut nonnulla paulo explicatius enarrem. In qua profecto mutationes
 “ illæ, quas commemorat HARVEUS, contingere jam incipiunt; namque in prior
 “ illa (quod sane prænarraſſe oportuit) nihil quicquam aut in albumine aut
 “ vitello mutatum reperi. De his tamen profiteor hic me nihil (nisi *de id wægdy*)
 “ dicturum, utpote quæ (ut superius de ipsa pulli corporatura dixi) non definitis
 “ admenſisque temporibus, sed, pro ovi indole ac vigore, maturius vel serius
 “ eveniunt. Vicinam itaque noſtram rursus adij, juſſique ovum, ſi quod forte jam
 “ modo editum habuiſſet, gallinæ ſupponere. Annuit, ac poſtquam ad horas
 “ plus minus 48. ſub gallina tepuiſſet, ad me perlatum eſt: eſſraſto cortice
 “ circa angulum ejus obtuſum diſrupi membranam illam duriorē, earumque,
 “ quæ totum ovum involvunt, primam; deindeque ſecundam (quam inter δ
 “ priorem aer incluſus continetur) detraxi, unde exilis hæc corporatura cum toto
 “ ſuorum vaſorum apparatu optime in conſpectum venit. Niſi vero membranam
 “ hanc amoveris (quamvis ita perluceat, ut & vaſa ſanguinea & ipſum punctum
 “ falienſ

“faliens utcumque per eam cerni queant) ita tamen etiam in rugas plicaeque ob
 “nimiam laxitatem contrahitur, ut ea non ablata nihil satis clare ac minutim
 “videas: & hinc forte accidit, quod ista, quæ jam allaturus sumus, aliis in hoc
 “tempore non comparuerint. Hæc autem membrana earum secunda est, quas
 “in embryotomia comparata enumeravit eruditiss. ac clar. vir. mihiq. amiciss.

“D. D. NEEDHAM. Eisto in fig. apposita A B albu-
 “men turbidius ac flavescens, veluti liquantem quod-
 “dam ex ipsius cum vitello permissione ortum (et
 “revera tale esse ex ipso postea HARVEO patebit;) in
 “cujus superficie jacet pellicula C (quæ tertia
 “membrana est, quæ totum ovum investit) vasis
 “undique sanguineis (quæ umbilicalium ramifica-
 “tiones sunt) resperfa; nisi quod media illius pars
 “(ubi liquor ista HARVEI clarissime refulgens, quo-
 “vis crystallino humore purior, hospitatur) nempe
 “G D E F; omnino hodie ab iis immunis appa-
 “ruit; quod certe mirum non est, cum in ovis
 “ostiduo incubatis duo tantum vasa illa umbilicalia
 “majoribus ramis & purissimi liquoris extremo ambi-
 “tu erumpere videantur; totaque ipsius colliquamenti
 “superficies nullum profus colorem ducat. In hoc
 “liquore visæ sunt duæ parvæ maculæ, & circa illas

Fig. III.



“corporatura quædam albida, crassitie quidem insignis, & in purissimo illo
 “humore quasi profundius demersa: si attentius spectes, intra istam corporatu-
 “ram rubedo quædam conspicua est, sed quæ alternis motibus interdum se
 “veluti in ipsam condere, iterumque ex eademmet emicare videtur. Interea
 “vasa illa sanguinea non ab hoc puncto rubro, verum ab ipsa colliquamenti
 “margine originem trahere putes: quod quidem post longiorem incubationem
 “luculentius patet, ut modo dixi: siquidem videre licet quasi ex ipso pulli ventre
 “(non certe a puncto saliente, ut clare animadvertere potui,) vasa aliquot san-
 “guinea, sed pauca, & reliquis, quæ in membranam ante dictam sparguntur,
 “majora, & medio colliquamenti versus marginem inflexa, circa illam erumpere,
 “& in ramos innumerabiles dispesci. Posthæc, totum vitellum (quem albumen,
 “sed infra circa H minime eliquatum aut turbidum sequebatur) effudi, reman-
 “sitque solummodo pellicula ante dicta, quam confestim in aquam tepentem
 “indidi, ubi se in marsupij cujusdam speciem explicavit, qua deorsum versa,

“apparuit illico; ulli corpusculum, huic membranæ inclusum, eique
 “per funiculum umbilicalem appensum hæc fere forma ut in figura IV. Fig. IV.

“Totum quidem albicans ac pellucidum erat, dumque hæc & illuc
 “converto, nec minima jam sanguinis gutta restaret, vidi in medio
 “veluti hujusce corpusculi punctum quoddam lucidissimum valde
 “exiguum, quasi gemmâ aliquam varias luminis stricturas evibrantem; quod
 “proculdubio cor erat. Duravit hæc ex systole & diastole facta micatio per
 “quartam circiter horæ partem, postquam totam pelliculam jam a pulli cor-
 “pusculo separassem; & adeo à prima inspectione, uti beneficio microscopij cog-
 “novi, per horas tres: quod certe jure mirari possumus, tantillam vitæ scintil-



“lulam

“ lulam non citius extinctam fuisse. Aderant præterea duæ tresque bullæ circa
 “ capitis regionem; macula quoque versus medium corporis crassior atque alba,
 “ quam jecur vel lienem fuisse arbitror; alia vero prope caudam cernebatur, quæ
 “ pedis erat exordium. Denique funiculus umbilicalis satis manifeste comparuit;
 “ cumque totum soli exposuissim, costas admodum albas & dorsi carinam cla-
 “ rissime conspicatus sum: atque hæcenus secunda observatio fuit.

Ad OBSERV. I. & II.

“ Cæterum ut ex allatis hæcenus observationibus fructum aliquem colligamus,
 “ manifeste hinc liquet, maturius longe pullum in ovo aut formari quidem, aut
 “ ipsius formationem inchoari saltem, quam harum rerum curiosissimus HARVEUS
 “ Exerc. xiii. aliique ex eo existimant. HARV certe clare innuit (quod a me jam
 “ supra est annotatum) *ova nonnulla celerius mutari, ac tertio ab incubatione die fetus*
 “ *primordia* (hoc est, ut ipse intelligit, sanguinem & punctum salientem) *exhibere,*
 “ *alia vero ad septimum usque diem nullum futuri pulli specimen edere.* Liqueat vero
 “ mihi ex factis aliquoties observationibus fidenter asserere, nupsiam ulla istius-
 “ modi primordia aut specimina futuri (ut inquit) pulli apparere, quin simul to-
 “ tus pullus jam præsens adsit, & sub dicta sæpius cicatricula delitescat: imo to-
 “ tum (ut ex prima obs. constat) pullum conspexi, antequam ovum ullam pror-
 “ sus mutationem passum esset; nisi quod cicatricula paulo forte amplior ac ma-
 “ gis æquabili circumductu prædita videretur. Quin adjicio insuper, quando-
 “ cumque aliqua ex istis mutationibus, quas ovum ex sententia HARVEI ordine
 “ subit, contingit, integram simul pulli corporaturam existere, ac modo prius in-
 “ dicato reperiri posse; & in ovis generosioribus ac spiritu plenis non tantum
 “ ante ipsam gallinæ incubationem, sed forte etiam ante ipsam e corpore ejusdem
 “ exclusionem. Hic vero magnopere advertendum est, me, etsi non dicam cum
 “ HARVEO ovum pro vario ipsius robore tarde aut celeriter in pullum proficere (quia
 “ magis verisimile arbitror, momento conceptionis totum simul ac semel confici)
 “ fieri tamen, tenellum hoc corpusculum omniaque adeo ipsius membra, pro
 “ ratione virium in ovo, ac repetitis forte galli coitionibus, citius aut segnius
 “ ab incubante gallina ad perfectionem educari. Quod idcirco monui, ne quis
 “ sorte me falsi insimulet, quod ipse easdem observationes facturum pullum simi-
 “ liter ante gallinæ incubitum non statim offenderim; namque mihi satis erit
 “ tam foelici fuisse, ut in tale ovum inciderim, ubi hunc oculis videre, manibus
 “ tractare, aliisque ostendere licuerit. Hortor illos itaque ad experimenta sæpius
 “ facienda, si primum non successerit; nec profecto abique causa: etenim accepi
 “ ab obstetrice expertissima & fide digna, a qua foetus humanos abortivos a li-
 “ quando petieram, difficillimum esse cum paucorum adhuc hebdomadam sunt,
 “ cavere, ne cum aquis (ut vocant) erumpentibus evanescant; præter summam
 “ nimirum teneritudinem ac mollitiem. Nec certe cuiquam hoc mirum videbi-
 “ tur, cui lectum fuerit illud cl. KERKRINO in accurata foetuum osteogenia nuper
 “ edita; ubi totum (ait) corpus in embryonibus ex mera membrana videtur consistere:
 “ & paulo supra, in iis etiamnum, quæ duorum mensium sunt, omnia capitis ossa membra-
 “ nea esse. Accedit huc, quod eadem alias mihi retulit, se quandoque vidisse foetus,

" qui unguem pollicis vixdum magnitudine æquabant, membris omnibus rite con-
 " formatos, cuticula quoque nitenti & polita exornatos : alios autem spithamam
 " totam longos, qui speciem quandam gelatinæ potius informis, quam fœtus hu-
 " manis redderent. Cum hisce consentiunt, quæ de ovis siue de abortibus hu-
 " manis sibi quoque contigisse narrat HARV. quorum in aliquibus fœtum quidem
 " invenit, in aliis vero nullum : verisimile autem est, in omnibus sane fœtus ad-
 " fuisse, sed præ summa mollitie dispersitos non apparuisse. Porro ex hæc-
 " leus allatis statuendum omnino videtur, nullo adhuc experimento liquere, quo-
 " præciue temporis momento aut pulli conformatio instituitur, aut quando pri-
 " mum in ovo conspici queat : longe autem a veritate aberrare maximum HAR-
 " VEUM, dum totius hujus formationis historiam a puncto suo saliente ceu pri-
 " mitive extructo, vel potius a sanguinis apparitione orditur ; cum aliunde certo
 " constet, punctum illud saliens micationes suas celebrare non posse absque ope
 " cerebri ac nervorum ; unde vel hac etiam ratione statui possit, cerebrum ne-
 " cessario existere, quotiescunque iste cordis rhythmus conspiciatur, etiamsi obser-
 " vationis fides non accederet. Atqui incertum adhuc ab experimentis esse quan-
 " do primum cernatur pullus ; cum in ovis generosioribus id quidem ante qua-
 " lemcumque gallinæ incubitum contingat, & forte antequam ab ipsa excluda-
 " tur ; in aliis vero, non nisi ab aliquot dierum foru & incallescencia satis firmita-
 " tis aut magnitudinis indispisci, ut oculis intuentium pateat. Quod si hæc ita
 " sint (vix sunt certissime) profecto plurima eorum concidant necesse est, quæ
 " paulo fufius quidem, sed non absque insigni facundia, ab HARVEO differuntur.
 " Nolo autem ob summam clarissimi viri auctoritatem & reverentiam singula
 " particulatim censere ; verum ea duntaxat, quæ proprius ex observatis ad veri-
 " tatem accedere videntur, exponam. Quantum itaque ex observationibus rite
 " factis colligere possumus, illa potius sententia recipienda est, quæ pullum uno
 " quasi ictu integrum constari, omnibusque suis partibus prædeditum esse, ipso
 " forte conceptus momento asserit. CL. HARVEUS contrariam quidem opinio-
 " nem, ex longa observationem serie deductam, tuetur : quare ut rem ipsam pe-
 " netius inspiciamus, necessarium erit, ipsius observationes aliquas cum iis, quas
 " supra adduximus, conferre. Commemorat autem in prima ovi inspectione vir
 " cl ; cicatriculam illam jam toties dictam a se primum pro origine pulli ha-
 " bitam : equidem haud inficior, ipsum quid hæc macula esset, multo clarius ac
 " distinctius explicare, quam quisquam alius fecerat. PARISANUS tamen (ut ab
 " HARVEO citatur) e macula ipsa pullum oriri agnovit, deque ea fortasse rectius
 " quam putarat HARVEUS, sensit : facile enim crediderim e verbis istis, quæ ex
 " ipso attulit HARVEUS, eandem fere ipsi quæ mihi observationem, obtigisse :
 " *præquam enim (inquit PARISANUS) rubor aliquis in fœtus corpore appareat, due*
 " *extant in eo minime bullule ; initio tamen rubore earum nulla prædita est.* Et hoc
 " quidem recte, quod tamen pæce cl. HARVEI dixerim ; qui ista continuo subjecit.
 " Exerc. xvi. *At vero nec bullula aliqua conspicua est antequam rubor sanguineus appa-*
 " *reat, &c.* Ego tamen (ut dixi) non modo bullulas duas (quas quidem male
 " PARISANUS pro corde ac jecore habet, cum oculorum potius rudimenta sint)
 " verum etiam pullum integrum conspexi, ut jampridem in obs. prima dictum
 " est. Equidem ex citatis PARISANI verbis haud ægre adducor ut credam, cum,
 " dum hæc investigaret, in hujusmodi ovum incidisse, quod integrum pulli cor-
 " poraturam

"poraturam in colloquamento demersam ipsi spectandum præberet. Sed cum quid
 "esset nesciret, binas solummodo builulas, utpote reliquis partibus conspectiores,
 "oblivasse, easque ex recepta tum fere apud omnes sententia, pro corde & je-
 "core habuisse. Cæterum, ut dixi, credibile est, eodem, quo fit conceptus, mo-
 "mento pulli corporaturam formari: quid enim aliud est conceptus ve: ipsi HAR-
 "VEO, quam papula ista, quæ oviparis ex ovario¹, viviparis ex utero erumpit? At-
 "qui autem (ut vivipara in præsens omitam) papula ista ovum est, ovum, inquam,
 "integrum; non vitellus tantummodo, ut initio operis dixerat HARVEUS; sed, ut
 "alibi rectius, EXERC. xxxvii. *aliquid potius compositum, quod ambos liquores (albumen
 "scilicet & vitellum) permixtos in se contineat: colore quidem vitellum refert, sed consisten-
 "tia sua propius ad albumen accedit, &c.* Quid quod alias quoque dicat EXERC. xxvii.
 "ovorum hæc primordia ceu papulas *propria anima vivere?* Denique verbis diser-
 "tis EXERC. xxviii; galli & gallinæ *fructus, sive conceptus communis, est ovum: paren-
 "tis utriusque virtutem referens.* Quidni autem maculam quoque ovo huic inesse
 "dicamus? Certe (satente HARV. EXER. xxix.) ovum secundum est sperma et semen
 "genitale, plantarum semini analogon; sed enimvero quod in plantarum semine
 "est germen, id in ovo sive animalium hoc spermate macula est, sive id potius
 "quod sub macula latet, pulli nimium corpusculum. Nec quinquam exterreat
 "corpusculi huius veluti immensa exilitas; namque, si ad calculum geometricum
 "res exigatur, facili ostendi possit, dari in rerum universalitate particulas actu
 "minores, quam quæ hoc corpusculum constituere debent. Præterea, cum re-
 "cipia consistet, ovum nihil esset aliud quam talis materie struem atque appara-
 "tum, unde corpusculum hoc ali atque augeri queat; cur, obsecro, putemus,
 "apparatum hunc adesse, pullum vero alendum neutiquam adesse? Per appara-
 "tum hunc, & ipsos liquores alimentares, & vasa ad eos deferendos necessaria,
 "& membranas, quæ vasa ista sustentant, intelligo. Namque, ut diximus, ten-
 "errima ista membrana, quæ in tepida natabat, innumeris ubique vasis obstita
 "erat; ut minime dubitarem, quin liquor aliquis in iis fuerit, & certe is ipse, qui
 "postmodum induta rubedine sanguinis appellationem obtinet. Qualis fere, ex-
 "empli gratia, in affatis aliisque testaceis (quorum sanguis semper albeat) videri
 "solet. Sed ut eo unde discissi redeam; *postquam ovum boras* 24. (inquit HARV.
 "EXERC. xv.) *tegitur, vitellus, qui prius in albuminis centro hærebat, versus cacumen
 "obtusum assurgit; sique ut vitellus cavitati per cicatriculam conjungi videatur.*
 "Id quod hoc vel consimili pacto evenire arbitror: dum gallina ovum incubat,
 "cuior ab ipsa proveniens ærem in superiori sive obtuso ovi angulo, ad usum re-
 "spirations (ut deinceps ostendam) relictum, insigniter rarefacit; unde is, quem-
 "admodum in Thermoscopio vulgari, liquores subditos premit. Cum autem vi-
 "tellus, a chalazis utrinque suspensus, membrana, albumen immediate obvolven-
 "ti, aliquantulum litreat, fit ut ipsum albumen facilius locum cedat, proinde-
 "que deorsum comprimatur, & vitellum in eo libratum versus superiora attollat.
 "Interim eadem opera membrana ista secunda simul detruditur, unde vitelli macu-
 "la cavitati veluti conjuncta apparet. Sed ad secundam jam inspectionem acceda-
 "mus; hic enimvero illud maxime animadverti, quod ipse fatetur EXERC. xvi. *adeo
 "tenacem esse ipsius colloquamenti membranam, ut, nisi summam curam adhibeas, fa-*

"Quod uteri tantum pars est superior & crassior.

"cile

cile diffiliat, fontemque confusione liquorum turbet. Idcirco minus mirandum est, si ipsa etiam foetus rudimenta, quæ juxta HARVEUM in medio hujus colliquamenti sunt, levissimo momento elabantur, nec quæsitâ hoc tempore omnino comparant. Occasione hujus colliquamenti addit HARVEUS, foetum in eo natantem, ex utero cervæ exemptum, regi CAROLO I. a se ostensum. Liceat etiam mihi similiter, hic foetum humanum (eoque gratius naturæ spectaculum & insolentius) memorare; viro cl. ac doctiss. D. D. CLARKE majestatis regiae medico, visum esse, in ovo suo natantem, membris omnibus exquisitè instructum & consummatum. Quinetiam jam apud me pullus in y adervatur, egressa corporis albedine in colliquamento suo spectabilis, semunciam fere longus; quem nonita pridem illæsa delicatissima ista membrana ex ovo exemi. Videamus inspectione tertiam, ubi optime monet Exerc. xvii; ea quæ jam videntur sic plerumque venire, non enim (inquit) est hoc perpetuum, cum magna sit in ovorum maturitate diversitas, &c. Et paulo post, quædam ova die quinto minus perfecta sunt quam alia tertio. Considera mihi, obsecro, an non hinc venerit, ut ipse pullum ante qualemcunque gallinæ incubitum repererim? Istaque præterea cuncta mihi fuerint oblata, quæ jam supra explicui? Ex quibus profecto consequitur, nescire nos penitus quo præcise temporis momento pullus formetur in ovo, seu papula potius: illud certum est, non errasse peritum (ut eum vocat HARVEUS) dissectorem, VOLCHERUM COITER, qui globulos secundo post incubitum die vidit; quod tamen negat HARVEUS. Prius vero quam ulterius pergam, nonnulla de ipsa hæc macula sive cicatricula annotare placet. Primo, inquit HARV. Exerc. xv. inspectionis die dicta macula dilatatur, & in circulos dispersitur, qui punctum album pro centro habent: equidem unicoloremi vidi, hoc est, totam albam, sed plerumque spatium quoddam fusci coloris inter albescentem circulum & centrum jam dictum interjacet, qui longiori incubatu amplior fit, imo in plures circellos quasi diffinditur; ipsumque tandem centrum evanescit; unde arbitror, maculas hæc omnes principio unicolores esse; sed ope caloris materia illa albidâ (quæcunque fuerit) e qua constituitur, paulatim in circulos diffille, tandemque in omnem undique partem amota, purum illum cicatriculæ liquorem detegit atque ostendit. Frustra ergo quæstionem hic agitât HARV. Exerc. xvii. punctum hoc album, quod maculæ centrum est, in rubrum illud saliens postea convertatur; nam si quis rem attentius pensitet, existimabit potius, materiam hanc albidam liquorem crystallinum obtexisse duntaxat, pullumque in ipso, ad cuius forte, dum mollissimus est, defensionem a natura comparata est. Cæterum de quarta jam inspectione dicamus, in qua nolo tam sollicitè veritatem consecrari, ut in virum, omnium seculorum memoria dignum, quemque a longinquo venerari debeo, quicquam inverecundius admisisse videar. Aio itaque, ea, quæ ibi tam eleganter curiosèque descripsit, procul dubio verissima esse, atque sic plane ipsi, dum per illæsum adhuc vitellum transpicere voluit, (ut fecisse eum non uno e loco hujus exerc. colligere possumus) apparuisse. Namque pulli corpusculum non eundemmet semper in liquore suo situm obinet, adeoque non isdem sui partibus se videndum præbet, ut mihi sæpius experto constat: nec aliunde provenisse autumo, ut quæ superius a nobis allata sunt viri perspicacissimi diligentiam effugerint. Cum itaque apud me cogito nusquam

“videri novo puctum saliens, aut lineam ullam sanguineam, quin tota pulli corpora-
 “tura reperiri queat, mirari subit ista verba Exerc. xvii: *certo constat, futuri setus*
 “*nihil omnino hoc die apparere (tertio scilicet) præter sanæ inas lineas & punctum sal-*
 “*liens.* Fateor equidem sub finem exerc. xviii. dicere illum hæc; *immisso in aquam*
 “*himpidam corporis rudimento, quid ejus factum sit, quid etiamnum desideretur, cogni-*
 “*tu facile esse:* ita se omnino res habet, atqui id fecisse se non meminit; ac de-
 “mus, fecisse; forte semel vel bis: unde facile evenire potuit, ut in sætu laceri-
 “ac laceris, atque ex ovo fortasse imbecilliori desumpto, omnia non perviderit. Quod
 “si experimentum hoc rite ac caute fuisse administratum, nequeo divinare quo-
 “modo pullum non repererit. Sed quid si ipse viderit? imo videt profecto, nec
 “enim aliud sonant verba ista Exerc. xviii. *In præstisribus ovis aliquando sub finem*
 “*quartidiei (imo ut plurimum, & citius, si ova spiritu & vigore abundant) nescio quid*
 “*turbidi vesicules pulsantes obumbrat, &c.* Preterea nebulam hanc corporis rudi-
 “mentum diserte appellat; sed in eo minus cum veritate consentire videtur, dum
 “ex colligamenti parte concoqui vult, & circa venarum principia concrevisse effusum
 “vocat. Alibi vero admodum prope ad ipsam accessit; ubi saturt dubitare
 “se, numnam salta colligamenti coagulatione una cum sanguine & puncto saliente
 “hoc etiam corporis capitisque rudimentum statim existeret (uti revera exillit) sed
 “tenue adeo & pellucidum (pulchre omnino & verissime) ut visum præfusus effugeret,
 “donec in situm & mucorem crassescens, albedinem induat qua præcipitatur: dum in-
 “terim sanguis crassior ac rutilans in colligamento tam diaphano facile conspicitur.
 “Hæc etsi paulo longiora exscribere tamen volui, quia ratio hinc optima peti
 “possit, cur non difficulter pulli corpusculum adesse concedamus, etsi quandoque
 “fortassis inveniri nequeat. Etenim præcipue animadvertendum est, alias sætos
 “partes præ aliis magis conspicuas esse; imo eas magnitudine & crescenti veloci-
 “tate cæteras antevertere, quæ usu præstatiores sunt, ac magis necessariae; quales
 “sunt cerebrum inprimis, quod proportionem reliquas omnes excedit superatque;
 “spina etiam seu carina dorsi; quippe ab his, omnem sensationem profluere mox
 “ostendat, quicquid contra de cordis sive puncti salientis irritatione dicat HAR-
 “VEUS Exerc. xvii. tum autem cor ipsum, quod intra nebulosum hoc corporis
 “concrementum (ut ex obs. nostra secunda constat) systolas & diastolas suas vi-
 “brans purpurei liquoris beneficio cernitur. Reliquis inspectionibus non immo-
 “rabor, in quibus omnia adeo clara & perspicua jam sunt, tamque accurate ab
 “HARVEO copioseque enarrantur, ut nulla super his contraversia exoriri queat.
 “Cæterum hoc loco opportunum erit, ea quæ contra sententiam HARVEI dispu-
 “tavit vir cl. ANTONIUS EVERHARDI paulisper despiciere: quæ & observationes
 “quidem nostras egregie confirmant. Enimvero vir iste eruditiss. eandem nobis
 “cum sententiam de instantanea animalium (ceu in proplasmate quodam) forma-
 “tione complectitur; eamque ex modo recensitis HARVEI verbiseruere velle vi-
 “detur: argumento (inquit) certissimo, corporis rudimentum, etiamsi præ exiguitate vi-
 “sum fugiat, una cum cordis corpusculo delineari. Postquam autem historiam suam
 “de animalium ortu ab experimentis cuniculorum extructam, absolvisset, hæc
 “habet: p. 73. *sed mirabitur fortasse quispiam, quod in primis meis observationibus*
 “*puncti sanguinei salientis & mentionem non fecerim, sed maximo initio meminim embryonis*

"jam conficiendi rudimenti, &c. & paulo post, fateor (inquit) punctum saliens f-
 "braque sanguineas in ovo primum quidem apparere (in quem proculdubio errorem
 "non incidisset, si, ut in cuniculis, de quibus summas ipsi gratias agimus, pa-
 "riter in ovis experimenta fecisset,) sed an eadem res ita se habeat in genera-
 "tione viviparorum, valde dubito, aut vix credo. Equidem vir cl. uti tu nos hac
 "in parte sublevasti, ita nos tibi (uti speramus) faciem aliquam in oviparis ac-
 "cendimus; ut adeo ex iis, quæ jam es dicturus, summa ista cognatio, ab ipso
 "HARVEO toties agnita, quæ viviparorum generationi cum oviparis intercedit, cla-
 "rius percipiarum; namque sic pergis p. 74. i. In productione cuniculorum punctum san-
 "guineum saliens, fibreque sanguineæ, post jactum futuri fetus rude fundamentum mihi
 "semper apparuerit; & hoc non modo in generatione cuniculi, sed ipsius etiam hominis
 "observavi. Ac plusscula in utroque genere exempla profert, quæ apud ipsum au-
 "torem inveneris. Profecto punctum hoc saliens rubrum primis quibusque incu-
 "bationis diebus potissimum cernitur in ovo: insequentibus autem e. confectu abire,
 "neque amplius extra moveri, sed obtegi ac cooperire videtur; ut optime (apud
 "HARVEUM; Exerc. xvii.) Ulysses Aldrovandus annotavit: duo autem (ait) ipsi meatus
 "venæ evidenter conspiciebantur, alter vero major altero. Quisque hoc facile
 "experiri poterit; quocirca paulo durior in cl. virum hoc in loco est HARVEUS,
 "dum falli ipsum asserit. Ut summam dicam, haudquaquam dubito quin maxi-
 "mus noster HARVEUS formationis partium pulli historiam verissime quidem ac-
 "curatissimeque adornavit; licet non eo quo extiterunt ordine (omnes enim in-
 "itio simul co-existunt,) sed eo quo ipsi apparuerunt. Video autem, duo mihi
 "hic monenda esse; nuppiam sere eodem aut consimili ritu pulli exordium in
 "colliquamento cerni, sed pro varia ejusdem in illo situ varique ovi indole, nunc
 "hoc nunc alio modo, sub obtutu cadere. Deinde ex ipso HARV. aliud t. xer. xx.
 "(et si jam supra idem dixerim;) ova quedam precocia & proveciora esse, omnique
 "explicata magis habentia; alia tardiora, membrisque (quod summe notandum est) mi-
 "nus distincta apparere. Quamquam alias non parum ad hanc rem faciant anni
 "tempus, locus, externa sumenta, diligens incubatio, &c. Hæc autem ideo mo-
 "nere necessum erat, ne quis forte, dum observationum nostrarum experimenta
 "capere aggreditur, etque quæ dixi non continuo offendat, eas aut sublece fidei,
 "aut saltem hallucinatum me, esse arbitretur. Quoniam autem ex dictis evidenter
 "liquet, longe aliter se habere formationem pulli in ovo, quam ab HARVEO
 "existimatum est; consequitur profecto, eorum magnam partem, quæ ex histo-
 "ria a se descripta deduxit, erroris haud immunem esse: uti sunt ea, quæ exerc.
 "li. de generationis ordine habet ac particula genitili prima; quaque exerc. lii.
 "de dignitate ac præstantia sanguinis, ejusque primo ortu; deensione puncti
 "salientis; nonnulla etiam, quæ de ovo tradidit, quod a sola gallina absque ullo
 "uspiam galli initu concipi posse sæpius asserit; alias vero diserte sibi adver-
 "sur exerc. xxviii. quicquid autem garriant anicula, hoc omni vere experientie
 "repugnare certum est. Quin etiam de pulli in ovo nutritione, ob incognitum
 "adhuc NEEDHAMI ac STENONIS ductum intestinale, ac adeo de ejusdem res-
 "piratione (cujus obs. pulcherrimam nactus sum,) dum intra ovum concluditur;
 "sed de his aliisque, quæ huc attinent, uti de sede libidinis in gallinis, earumque
 "fecunditate a galli coitionibus magis minusve aucta, ubi plus otii erit, discep-
 "tabo."

April

April 4. Mr. HOOKE made an experiment with two pieces of glass stiffly rubbed upon one another, to shew that there may be the same incidence of rays, and yet various colours. And he was ordered to bring an account of this experiment in writing at the next meeting, together with his considerations upon it; as also to draw up and give in an account of the experiment, made at the last meeting, with sal-nitre dissolved in common water.

Mr. OLDENBURG produced a printed sheet in folio, dedicated to the Royal Society by Dr. JOHN SWAMMERDAM, a physician in Holland, concerning the structure of the *uterus* and *ovarium* belonging thereto, &c. It was recommended to the consideration of Dr. SMITH and Dr. BROWN, who were desired to make a report to the Society at their next meeting, of what might be peculiar in it.

Mr. OLDENBURG communicated a letter to him from Mr. NEWTON, dated at Cambridge 30th March, 1672 *, containing his answer to the difficulties objected by Monsr. AUZOUT against his reflecting telescope: as also the queries of Monsr. DENYS concerning it; together with Mr. NEWTON's proposal of a way of using, instead of the little oval metal in that telescope, a crystal figured like a triangular prism.

Mr. HOOKE was ordered to make such a crystalline prism for the design mentioned in Mr. NEWTON's letter, and to try the same.

There was read a paper of Dr. GREW, sent to Mr. OLDENBURG from Coventry, 12 March, 1672, containing some observations about snow; which was applauded as an ingenious discourse, and ordered to be registred †.

Mr. HOOKE promised to bring in some other experiments of colours at the next meeting.

The reading of Dr. CROUNE's Latin discourse, *De Formatione Pulli in Ovo*, was ordered to be continued when himself should be present.

April 10. At a meeting of the COUNCIL were present,

Sir ROBERT MORAY vice-president,
The lord viscount STAFFORD,
The lord HENRY HOWARD of Norfolk,
The lord bishop of Chester,
Sir THEODORE des VAUX,

Dr. GODDARD,
Mr. COLWALL,
Dr. WALTER NEEDHAM,
Mr. CREED,
Mr. OLDENBURG.

* Letter-book, vol. v. p. 193. An extract of it is printed in the *Philos. Transact.* vol. vii. n° 42. p. 4034.

† Register, vol. iv. p. 92. It is printed in the *Philosoph. Transact.* vol. vii. n° 92. p. 5193, for March, 1673.

There was made a proposal from Mr. EVELYN by Mr. OLDENBURG, for letting out Chelsea college to be a prison house during the war^{*}; together with an intimation, that Mr. EVELYN hoped to procure a rent of one hundred pounds a year for it, besides some necessary repairs of the house. Hereupon it was ordered,

That the president, the treasurer, and the secretary, who officiates, should have power to agree, in the name of the council, with Mr. EVELYN, about the matter proposed, and conclude with him and his colleagues, if the above-mentioned hundred pounds *per annum*, together with good repairs, could be obtained; and that upon the agreement concluded, they make a report to the council, in order to its passing under the seal of the Society: and that Mr. EVELYN be thanked for his care of the concerns of the Society:

It was propos'd by the lord HOWARD, that care might be taken to let out the the five acres of land lying about Chelsea-college, to some person or other, who would hedge it about, for any rent.

Sir ROBERT MORAY hereupon propos'd, that he would speak with captain THORNHILL about letting that land.

It being mentioned by Mr. HOOKE, who was called into the council, that Sir JOSEPH SHELDON had spoken to him of fifty acres of land, which he believed to belong to Chelsea-college; it was ordered, that the president should be desired by the council to take notice of this information, and to confer with Sir JOSEPH SHELDON about it.

The bishop of Chester propos'd Dr. GREW to be a curator to the Society for the anatomy plants for a year, upon subscriptions, amounting to fifty pounds, to be made by such members as should be willing to contribute thereto.

The council approved of this proposal, and ordered, that it should be signified to the body of the Society at their next meeting, in order to actual subscriptions.

It was moved by the vice-president, that whereas Thursday proved inconvenient to divers considerable members of the Society to meet, that day might be changed again, and Wednesday appointed for the weekly meeting-day, as it had been formerly.

The council approved of this change, and ordered, that it be signified to the Society at their public meeting, on the Thursday following.

It was ordered, that the treasurer pay one year's salary to Mr. HOOKER.

^{*} With the States-General.

April 11. The Society did not meet.

April 18. Mr. Hooke was ready to make an experiment by a prism, viz. to destroy all colours by one prism, which had appeared before through another: but there being no fun, as was necessary, the experiment was deferred.

Several letters to Mr. OLDENBURG, concerning matters relating to the Society, were read.

1. From father PARDIES the jesuit, professor of mathematics in the college of Clermont in Paris, dated there April 9, 1672, N. S.^o containing some objections against Mr. NEWTON's theory of light and colours.

2. A letter from Mr. NEWTON, dated at Cambridge April 13, 1672^o, containing an answer to the objections of the said jesuit.

3. Another letter from Mr. NEWTON of the same date^o, answering some experiments proposed by Sir ROBERT MORAY for the clearing of his theory of light and colours.

4. From Signor MALPIGHI, dated at Bologna April 5, 1672, N. S.^o, expressing his readiness to comply with the Society's desire, that he would continue his diligence in the anatomy of plants, and his observations on the formation of a chick in the egg.

Mr. COCK having produced a concave of steel for a reflecting telescope, which, he said, he was not able to make all over of the same hue, it being in its greatest part darker than in the rest about the edges; he was ordered to polish it as it was.

Mr. Hooke proposed a way of making these reflecting concaves in great numbers, and polished by the means of two dyes, one concave, the other convex, putting between them a plate of silver, and then stamping them with the mint-mill.

It was doubted by Mr. ROBERT MORAY, whether it would be polished this way, and keep its figure. However, it was thought worth trying; and therefore it was ordered, that Mr. SLINGSBY should be desired from the Society to see this experiment tried for them.

There were read some observations concerning the voyage lately made to East Hudson's Bay, and the state of that country and its inhabitants, communicated

^o Letter-book, vol. v. p. 204. It is printed in the Philosoph. Transact. vol. vii. n^o 84. p. 4087.

^o Letter-book, vol. v. p. 218. It is printed in the Philosoph. Transact. ubi supra p. 4091.

^o Letter-book, p. 222. It is printed in the Philosoph. Transact. n^o 83. p. 4059.

^o Letter-book, vol. v. p. 202.

to Mr. OLDENEURO upon his inquiries, by captain GUILLIAUME and Mr. BAILEY, two of the chief persons employed in that voyage, who had wintered there. These queries and answers were ordered to be registered *, and were as follow :

“ 1. What time of the year they set out from hence, and when they arrived at the place intended? Ref. They set out June 5. and landed August 22. in the bottom of East Hudson's Bay, being fifty degrees and forty-five minutes north latitude, and distinct from the west bay, the place of captain JAMES's wintering, which was in fifty-two degrees and thirty minutes latitude.

“ 2. In what degree of latitude they met with the first ice, and at what time of the year? Ref. In fifty-nine degrees; in the beginning of August, they met with icy islands moving.

“ 3. How far north they sailed? Ref. First, to the entry of the straits, that let them into Hudson's Bay, which entry is at six and an half degrees north latitude, whence they run up higher to the latitude of sixty-three degrees (the most northward place they went to) and thence they run down again near three hundred leagues due south, to about the latitude of fifty-one degrees, and longitude about three hundred and seven degrees.

“ 4. In what month the most northern parts, which they must make, are most convenient to pass? Ref. In August and September; and they hope they shall be able hereafter to go and come in one and the same summer, by ordering their voyage so, as to be there about the middle of August, and by coming away about the beginning of September, the commodities of the place lying, upon agreement with the natives, ready to be shipped immediately upon their arrival.

“ 5. What depth of water they had where their ship anchored, and they wintered? Ref. About nine or ten foot, but in the strait's mouth, it is so deep, that they found no ground at three hundred fathoms; and all along within those straits deep enough, though many islands every where.

“ 6. What they observed as to the variation of the needle? Ref. At fifty-three degrees they reckoned no variation; about fifty-four degrees they reckoned about one degree of variation, westward; and thence the variation increased very considerably, so that, at the entry of the straits in sixty-one degrees and an half of latitude at Cape Worlesnam, the needle varied thirty-two degrees westward, and at sixty-three degrees at Digges's island, it varied about thirty-six degrees; but running down to the south for about three hundred leagues, to the latitude of fifty degrees and forty-five minutes it varied twenty-six degrees. Captain JAMES reckoned twenty-nine degrees variation where he wintered.

“ 7. What observable about the tides? Ref. In those straits there runs a constant tide, east south east, and west south-west, but in the bay it runs north

* Register, vol. iv. p. 190.

“ and

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1672.] "and south; entering into the straits a south-east and south moon maketh a full sea; but further within the straits a fourth moon doth it; and where they wintered a fourth south-west moon maketh a full sea. The tides commonly rise not above eight foot perpendicular height, though they are much governed by the winds, which are very variable there, and being high from the north-west, raise the tides to the height of twelve foot in Rupert's River.

"8. Whether the thick foggy air did make their compass move so dully, that it would not traverse? Ref. This, they apprehend, would come to pass, but they prevented it by using Muscovy glaſs.

"9. What kind of people the natives are where they wintered? Ref. They are tawny, living in tents, which they remove from place to place, according to the seasons of hunting, fowling, and fishing. Their arms are bows and arrows; their meat is venison, wild fowl, (as geese, partridge) and rabbits, all which are as white as snow, and in great abundance; the captain affirming, that he had killed seven hundred such white partridges. They have also store of fish, as sturgeon, large pikes, salmon-trouts, taken by them with nets; great fish they had seen none, but some sea-horses and seals, going into the bay; no cod nor whales. As to their drink, they use much the broth of their boiled venison, no crude water. Concerning their physick, they use chiefly sweating, not by taking any thing inwardly, and then pouring water upon them, whereby many stones red hot, in their tents, and then making a kind of stove, where by they are made to sweat excessively, in which condition, when they have sat a while, they run out into the snow, whereby they say their pores are presently closed again, as they were opened by the heat, laughing at the live Europeans, that cause themselves to be rubbed and dried with cloths. They "south many of them to a great age, to an hundred and twenty years. From the "diary west of Carleton island, about fifty degrees latitude, there came many Indians to them, that were six foot nine inches tall, living among the freshest, "and from much upon fish, on the river Moussibi, that is the river of elks, so called "from the store of elks, that are to be found there.

"The commodities they delight in are coarse cloth, iron, hatchets, hammers, kettles, pins, needles, and such like, very ready to exchange them for beavers.

"10. What kind of soil it is, and what it produceth? Ref. It is most clay ground, plain, and very moist, bearing no grain at all, only vetches, gooseberries, straw-berries, cran-berries. It abounds in wood, especially birch, willow, and fir-tree, which last kind of tree hath an excellent turpentine (as they call it) on its bud, which boiled in their beer they found very wholesome, and restoring them to strength and vigor when they looked pale, and were sick and weak.

"11. What animals the country affords? Ref. Store of deer, hares, elks, for other beasts, there are white "and beaver, all which are very good meat: "foxes,

“foxes, white bears, white cats, all yielding excellent furr, which is exceeding thick.

“12. What observable chiefly about beavers? Ref. They said, they had not been up so far into the freshes, (for upon them they only live) as to see themselves their manner of living and breeding; but they had been told by the Indians, that they build their lodges, two stories high, cutting pieces of wood from the neighbouring trees, of that length and bigness, as is requisite for their purpose, and then meeting a competent number of them together, whereof the one half place themselves on one side of the piece to be shoved away, and thrust their tails under the wood to the other side, where the other half standing ready, do fasten their teeth into the tails of the other, and so shove away the wood to the place designed to build in, where they raise two stories, to the end, that when the water swells, they may go up to the other story, in which they also breed their young ones. Beavers live not upon fish, but rinds of trees.

“13. How the captain of our ship and his company ordered themselves as to their manner of living, whilst their staying there? Ref. When they came on shore, they built themselves a house of wood, and dug a cave some eight or ten foot deep, into which they put some barrels of good beer, which at the time of their coming away being taken up again, after it had remained there eight or nine months, proved very excellent liquor. Mean time they brewed all the winter long, of the provision of malt they had taken with them; and for their meat they went a hunting, and with their guns killed store of deer and fowl.

“14. What temper they found that country of in the months of May and June? Ref. The spring began in May, in June they found it pretty hot in the day-time, and store of muskittos, but frost in the night.

“15. How they had their health there? Ref. Reasonably well; only in returning they found some trouble of the scurvy, and that chiefly in their mouths.

“16. What government and religion they have amongst themselves? Ref. They have some chief persons that are above the rest, yet working with them; they found no quarrelling amongst them; they love keeping one's word; are very sensible of love and kindness; and they express their hearty forgiveness, by a gesture of throwing the arms behind their back, which when they do, you may rely upon them as perfectly reconciled. They acknowledge some supreme power, which they call Maneto, and they have a Pawaw, by whom they address themselves to their God, and acquaint him with their necessities, which Pawaw returns them answer of help and relief, and that commonly upon conditions of giving such and such commodities, among which tobacco is one of the chief.”

The

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The Society was made acquainted with the two particulars lately passed in the council April 10, 1672: the one, that the day of the Society's weekly meetings was henceforth to be on Wednesday again, as it had been formerly; because Thursday proved inconvenient to divers considerable members of it, who were assiduous at their meetings. Upon which it was ordered, that tickets should be sent to the members about London, who were not present at this meeting, to give them notice of this change. The other was, that the bishop of Chester had proposed Dr. GREW to be a curator to the Society for the anatomy of plants for a year, upon subscriptions amounting to fifty pounds, to be made by such members as should be willing to contribute for the raising of that sum; and that the council had approved of that proposal, a form also being drawn up, and now ready for the subscriptions of such, as would freely contribute to so good a work.

It was ordered, that the thanks of the Society be returned to the lord bishop of Chester for this proposal, and to the council for their approbation of it: as also, that his lordship be desired to take care of the subscriptions.

Mr. Hooke promised some experiments about colours at the next meeting.

April 24. Signor JOHN DOMINIC CASSINI and FRANCIS VERNON, F.R.S. were proposed candidates by Mr. OLDENBURG, they both having intimated their designs of being elected into the Society, in their letters from Paris of April 23, 1672, N. S.*

Mr. Hooke shewed two experiments of colours with a couple of prisms. By the one he produced; it appeared, that one prism took off the colours, which the other had produced: by the other, that several colours were made by several refractions. He was ordered to give in the particular description of these experiments to be registered.

Signor CASSINI's letter to Mr. OLDENBURG of 13d April, 1672, N. S. presenting the Society with the printed description of his late observations concerning the periodical motion of a great permanent spot in Jupiter, and the phenomena of the late comet, was read.

Mr. OLDENBURG read also the letter of thanks^y, ordered by the last meeting to be returned to Signor MALPIGHI, which was approved of, and ordered to be sent away.

There was likewise read a Latin letter to Mr. OLDENBURG, from Dr. THOMAS CORNELIO, dated at Naples 5th March, 1671, N. S.* expressing his great respect for the Society, and its institution; accompanied with a letter of his in

* Signor CASSINI's letter is inserted in the Letter-book, vol. v. p. 229, and Mr. VERNON's, p. 119.

^y It is dated April 24, 1672, and is entered in the Letter-book, p. 231.
* Ibid. p. 179.

Italian, to JOHN DODDINGTON, Esq; the king's resident at Venice *, containing divers particulars relating to the tarantula, and the relations of persons pretending to be stung by them.

May 1. Signor CASSINI and Mr. VERNON were again proposed candidates by Mr. OLDENBURG, upon the desire of both of them expressed in their letters of April 23, 1672. N. S.

Dr. WILLIS presented to the Society his book, intitled, *De Anima Brutorum Exercitationes duæ, prior Physiologica, altera Pathologica*, printed at Oxford, 1672, in 4to.

Mr. BOYLE shewed an experiment, importing, that water will easily pass where air will not. He was desired to give the contrivance of the whole, and his considerations thereupon in writing, to be registred.

Mr. OLDENBURG read a letter from Mr. LISTER to the archbishop of York, dated at York 10th April, 1672 †, and by his grace communicated to the lord archbishop of Canterbury, who delivered it to Sir ROBERT MORAY, in order to be imparted to the Society. It contained an exact account of the excision of a stone from under the tongue of a man, where it had been breeding about eight years. It had visible impressions upon it of some capillary vessels, amongst which it grew; and it was scabrous and sand like, though the substance was topaceous.

Dr. KING affirmed, that he had found the like stone come away out of the tongue of a gentleman.

Mr. BOYLE remarked, that he had seen the like.

Dr. KING related on this occasion, that having opened a gentleman, who died upon strange swooning fits, he found, after long inquiry had been made of the seat of his disease, a small stone on the top on the inside of the *arteria venosa*, depressing the vessel, and thereby hindering the circulation. He was desired to give this relation in writing for the register-book.

There was read another letter from Mr. LISTER to JOHN BROOKE, Esq; dated at York 12th April, 1672 ‡, containing an observation about the generation of hair-worms, and shewing, that such things, as are vulgarly thought animated hairs, are very insects, nourished within the bodies of other insects, as *ichneumones* are within the bodies of caterpillars.

* A translation of it is printed in the Philosoph. Transact. n° 83. p. 4062. Transact. vol. vii. n° 83. p. 4065.

† Letter-book, vol. v. p. 203. It is printed in the Philosoph. Transact. vol. vii. n° 83. p. 4064.

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The lord bishop of Chester affirmed, that he had found the like; which was confirmed by an observation of Mr. Boyle.

There was read a letter of RICHARD TOWNLEY, Esq; to Mr. OLDENBURG, dated April 15, 1672, containing an observation of his, that if two thermometers, which in his chamber corresponded exactly with each other, one being so placed in a coal-pit as not to be in the way of the current of air, was found by him to have kept above two months at a constant station; whereas during that time the thermometer at home varied very much.

May 8. A book intituled, *A New Years Gift for Dr. Witlie*, by GEORGE TONSTAL, M.D. was presented from the author to the Society. It related to the controversy between them concerning the Scarborough Spaw.

The minutes of the last meeting being read, and Mr. LISTER's letter concerning the Production of hair-worms again taken notice of, Mr. WILLOUGHBY affirmed, that he had found in all sorts of fishes and birds, which he had opened, as also in some quadrupeds, such worms lying loose in the cavity of the belly, without the guts. He promised to send to the Society the names of all those animals, in which he had found them.

There was read a letter of Mr. NEWTON's to Mr. OLDENBURG, written from Cambridge, May 4, 1672, containing his judgment of Monf. CASSEGRAINE's telescope, printed like that of Mr. JAMES GREGORY, described in his *Optica Prometa*, the light in the year 1663, with a h-le in the midst of the optic metal to transmit to an eye glass placed behind it.

Mr. COOK produced a piece of steel polished, to be used in the reflecting telescope.

Mr. HOOKE was desired to make tryal with it, though he said it was falsely polished.

Dr. GREW, the new curator for the anatomy of plants, being present, was desired to produce some observations on that subject at the next meeting; which he promised to do. In order to which it was ordered, that Mr. Hooke should deliver to him the Society's microscope.

May 15. Dr. GREW made some observations about the secundine, or innermost cover of the seed in plants; of which he produced a description in writing, which was ordered to be registered; as was also the scheme, which he gave in, containing the heads of the most considerable particulars concerning vegetables.

Letter book, vol. v. p. 327. It is printed in the Philosoph. Transact. vol. 5. n^o 53. p. 4057.

Register, vol. iv. p. 187. It is published in his *Anatomy of Plants*, Edit. London, 1682, folio.

Vol. III.

H

Mr.

Mr. SMETHWICK brought in an instrument shewing the angles of refraction; and was desired to draw the figure of it, and to describe the construction and uses thereof.

Mr. HOOKE made some experiments relating to Mr. NEWTON's theory of light and colours, which he was desired to bring in writing to be registered.

May 22. Signor CASSINI was elected unanimously.

Mr. VERNON was likewise elected.

The secretary was ordered to signify to Signor CASSINI his election.

Dr. GREW shewed the Society, in a microscope, the conformation of the pith in vegetables, viz. that the whole pith is nothing but a *rete mirabile*, or a wonderful complication of exceedingly small fibres; of which he gave in a larger account in writing, which was ordered to be registered ^a.

He was desired to prosecute this subject, in order to find out the use of the pith, and to consider the variety and difference of the piths in several plants; as in bull-rushes, elder, cork, &c. their figures, whether circular or angular; as also whether they be always dry or juicy in young plants, &c. Farther, to cut the wood asunder, and to cut the wood into the pith, to see how the plant will grow.

Sir ROBERT MORAY brought in an account of cacao-trees, their planting and culture, the way of curing them, the observables in their fruit, &c. transmitted to him by Sir THOMAS LYNCH from Jamaica; which was ordered to be registered ^b.

Mr. HOOKE made some more experiments with two prisms, confirming what Mr. NEWTON had said in his discourse on light and colours, viz. that rays of the light being separated by one prism into distinct colours, the reflection made by another prism doth not alter those colours.

It was intimated by Mr. HOOKE, that these experiments were not cogent to prove, that light consists of different substances or divers powders, as it were; but that these phenomena might be explained by the motion of bodies propagated.

Mr. BOYLE produced some of the plant *datura*, sent him out of the East Indies; which is a kind of stramonium, and famous for so taking away the understanding of persons, that, when they recover, they remember nothing of what they did, or was done before them, during that stupefaction.

^a Mr. OLDENBURG's letter to Signor CASSINI for that purpose, was dated 27th May, 1672, and is entered in the Letter-book, vol. v. p. 251.

^b Register, vol. iv. p. 188. It is published in his Anatomy of Plants, b. 2. c. 5.

^c It does not appear in the Register.

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He mentioned, that he intended to make some tryals with it upon dogs, and in particular, whether it be true, that that stupor can be taken away in a very short time, and in what quantity it will kill.

The Society adjourned till June 5th, the Wednesday following being the anniversary of the king's birth and restoration.

June 5. The Society did not sit: but there was produced before the members present, by Mr. CONVERS, a speaking trumpet of a different fashion from that of Sir SAMUEL MORLAND^a, by a pipe in a pipe rendering the voice by reflection.

He was thanked for the respect intended by him to the Society, and acquainted, that at their next meeting they were likely to recommend this contrivance to the examination of some of their members.

June 12. At a meeting of the COUNCIL were present

Sir ROBERT MORAY, Vice-
President,
Sir PAUL NEILE,

Sir THEODORE DE VAUX,
Mr. AERSKINE,
Mr. OLDENBURG.

It was ordered, that Signor MALPIGHI's book, intituled *Marcelli Malpighii Philosophii & Medici Bononiensis Dissertatio Epistolica de Formatione Pulli in Ovo*, be printed by the printer of the Society; and the form of the license to be as follows;

"Junii 12, 1672.

"In concilio Regiæ Societatis Londini ad scientiam naturalem promovendam institutæ.

"Tractatus, cui titulus *Marcelli Malpighii Philosophii & Medici Bononiensis Dissertatio Epistolica de Formatione Pulli in Ovo*, Regiæ Societati dicata, imprimatur a JOHANNI MARTYN, dictæ Societatis typographo."

At a meeting of the SOCIETY on the same day Mr. VERNON was admitted.

Dr. GREW shewed the Society in a microscope those *tracheæ* of a spiral form, described by Signor MALPIGHI to be in all vegetables: and of this he gave the description in writing, which was read, and ordered to be registered^b.

Mr. OLDENBURG presented from the author a book of Dr. SWAMMERDAM, by whom it was dedicated to the Society^c, and intituled *Uteri Mulieris Fabrica, una*

^a An account of his speaking trumpet, with its use both at sea and land, was published at London in 1671.

^b It does not appear in the Register.

^c In the dedication Dr. SWAMMERDAM declares *nescire se, quo factum sit factu, ut, quædam verba Christianus urbi non minus religiosus sue incrementa Angliæ grati debet. Ita ultimus defensionis hæc his* cum

cum Methode nova Cavitates Corporis ita preparandi, ut suam semper genuinam faciem servant: Printed at Lyden, 1672, in 4to.

It was ordered, that a letter of thanks be written to him², assuring him of the kind reception of his present, and respect.

Mr. OLDENBURG read a letter from Signor MAGALOTTI, dated at Florence, 20th May, 1672, N.S.³ giving an account, accompanied with a scheme, of a Venetian project of a perpetual lamp made up in a crystal vial with spirit of wine and a wick of gold, so contrived, that supposing the spirit of wine converted from a liquor into smoke, and from smoke into vapour, will turn again into an inflammable liquor, there may be a perpetual circulation, and consequently a perpetual lamp. But several of the members declared, that spirit of wine being once destroyed by the fire will not turn into spirit of wine again.

Signor MAGALOTTI had inclosed in this letter a relation of Dr. GORNIA, physician to the Grand Duke, when the latter was in England, concerning an antient man living in the mountains of Italy, out of whose leg, being ulcerous and neglected, a horn was grown of a considerable bigness.

Mr. OLDENBURG produced Mr. NEWTON's answer to Mr. HOOKE's considerations upon his discourse on light and colours; which answer was read in part, and ordered to be copied for the perusal of Dr. WREN and Mr. HOOKE, and then to be registered⁴.

Mr. HOOKE was put in mind to bring in at the next meeting some experiments, that do not depend on the shining of the sun, together with those that require sun-shine.

June 19. Mr. HOOKE's account of some experiments on refractions and colours, lately made by him before the Society, was read, and ordered to be registered⁵, as follows:

"In order to examine, whether several colours, after the first refraction, would have several refraction, I made several experiments; and the first was, I took two prisms, and with the one I cast the rays of the sun upon a wall, at a considerable distance; by which means the several colours of the rainbow appeared in a line at right angles with that of the prism, viz. red, yellow,

temperibus apud eam inventa sit ratio, quâ, missis inanis scholasticorum disputationibus, bene arces et scientie in solida locetur. Quod ipsum, ut non postremam gloriae Britannicæ partem absolvi, ita in eam à se, ut in autoris philosophia necesse ad nullum aliud quam Reg. & Societatis tribunal provocare vel ausu vel debet.

⁴ Mr. OLDENBURG's letter was dated 1th June, 1672, and is inserted in the Letter-book,

vol. v. p. 275.

⁵ This letter was written in English, as appears from Mr. OLDENBURG's answer of 13th June, 1672. Letter-book, vol. v. p. 271.

⁶ It does not appear in the Register, but it is printed in the Philosoph. Transact. vol. vii. n^o 88. p. 5084, for November 1672.

⁷ Register, vol. iv. p. 194.

"green,

" green, blue, and purple: then with a second prism, placed in a parallelism
 " with the aforesaid line or order of colour; I a second time refracted the rays
 " of the sun, or the several-coloured rays, and thereby found, that all the said
 " colours would be a second time refracted, and yet keep their several colours
 " distinct in the same order, without very sensibly intermingling any other colours
 " with any of them. Moreover I found, that the several colours, though they
 " kept their former order, viz. the second refracted red, yellow, green, blue,
 " purple, kept the same order and position with the first refracted red, yellow,
 " green, blue, purple; save only, that whereas I held the second prism in a
 " parallelism with the order or line of colours, the colours cast upon the wall
 " by this second refraction were not parallel, but askew, or oblique; and, upon
 " examining which was most bent from the parallelism by refraction, I found the
 " purple, and the rest less, in their order: that is, that the purple was farthest
 " distant from the first line of refracted colours, and so consequently, according
 " to the hypothesis of the differing refraction of colours, purple had the greatest
 " refraction, blue the next less, green less than that, the next yellow, and red
 " the least of all; which seems at first much to confirm Mr. Newton's theory
 " of colours and light; but yet I think it not an *experimentum crucis*, as I may
 " possibly shew hereafter.

" Next, I tried a second experiment, by casting with the first prism the line or
 " order of colours upon the wall, and taking a black stick, and laying it exactly
 " parallel with the said line, so as to touch the upper or under side of the said
 " colours, if the colours were cast in a horizontal posture, or the right or left
 " side, if cast in a perpendicular posture: then taking a second prism, and hold-
 " ing it exactly parallel with the stick or the line of colours, and looking through
 " the same, I could plainly see the stick and the colours; and whereas, with my
 " naked eye the colours seemed just to touch the stick, and to be parallel there-
 " with, now they seemed to lye askew, and the stick to pass through them; and,
 " which way soever the refraction of the second prism did bend the rays, that way did
 " the purple bend most, and the red least; insomuch, that I have often observed,
 " that when the colours of the first rainbow were cast above the stick, by looking
 " on them thus, I could see them on the other; which at first seemed not a
 " little strange.

" Thirdly, I cast the colours by the first prism upon the floor, or ceiling, or
 " wall, and with the second prism held exactly, or, as near as may be, parallel
 " with the first, I looked at those colours, but by such a side of the prism as
 " refracted the rays quite contrary to their refractions in the first prism; and it
 " was obvious to see, that by turning the second prism (whilst in its parallel
 " position) round on its axis gently, the colours on the floor, wall, or ceiling,
 " would by degrees quite vanish and disappear, and the rainbow (if I may so
 " call the breadth of colours which before possibly was almost a span breadth
 " upon the place, contracted itself by degrees to the breadth of the first prism;
 " but if the said rainbow was looked on through the second prism with a refraction
 " "

“ the same way with the refraction of the first, the breadth of the same was
 “ very much stretched, and made a span and a half, or two spans, broad.

“ Fourthly, I took two thin pieces of glass well plained and polished, the
 “ thinner they are (so they do not break) the better; and putting them one
 “ upon another, I prest them hard together till there began to appear a red-
 “ coloured spot in the middle; then continuing to press them closer, I could
 “ plainly see several rainbows, (as I may so call them,) of colours, encompassing
 “ the first plate; and continuing to press the same closer and closer, at last all
 “ the colours would disappear out of the middle of the circles, or rainbows, and
 “ the middle would appear white; and if yet I continued to press the said plates
 “ together, the white would in several places thereof turn into black. The first
 “ colour that appeared was red, then yellow, then green, then blue, then purple;
 “ then red, then yellow, green, blue, purple; red, yellow, green, blue, purple, and
 “ so onwards: so that I have numbered nine or ten several rainbows, or orders of
 “ colours, one immediately within another, and the red immediately next to the
 “ purple, and the last colour, that appeared before the white, was blue: so that it
 “ began with red and ended with purple, and where there was no other colour pre-
 “ ceded, the red had no purple; but where red was on the one side, and blue on
 “ the other, there was purple; that way, that the red and the blue were dilated,
 “ was yellow, sky-colour, and green; and that way they were heightened was
 “ purple: still the said rings, or rainbows, would vary their places, by varying
 “ the position of the eye, by which they were observed, and not only their posi-
 “ tions, but their colours; so that the glasses remaining the same, that part,
 “ which was red in one posture of the eye, was blue to a second, green to a
 “ third, yellow to a fourth, and purple to a fifth, and other mixt colours to
 “ other postures. Moreover, that, which gives one colour by reflection, gives
 “ another by trajection, not much unlike the tincture of lignum nephriticum.
 “ Of the explication of these phenomena by various hypotheses more hereafter.”

Mr. HOOKE was desired to make more experiments of the same nature, for a farther examination of Mr. NEWTON's doctrine of light and colours; especially such as might make it out, that colours may be varied by divers positions of the eye; as also those, that are made with plated bodies, shewing, that the same inclination and the same thickness will give various colours: and farther, those, that shew in a dark room, that where there is no refraction nor reflection, there will be a succession of colours; so that the rays passing only a hole, colours will appear.

Dr. GODDARD and Mr. CONYERS having brought in several figures for speaking trumpets, and Mr. HOOKE having also drawn one for the same purpose, the operator was ordered to attend Dr. GODDARD, and to take directions from him for causing such instruments of the produced figures to be made as the doctor should appoint: and Mr. HOOKE was desired to make also a trial of his figure.

Dr. ISAAC VOESIUS mentioned, that they had a way at Amsterdam of making bells give a much sweeter sound than ordinary, retaining the usual bell form, but employing only half the quantity of the metal, and observing a great equality in casting it.

Mr. OLDENBURG read a letter to him from Mr. HEVELIUS, dated at Dantzick, June 10, 1672¹, giving notice, that he had printed a discourse of the observations of the late comet, made by himself, and had sent some copies of it by sea, to be distributed here. This letter was accompanied with a printed scheme, representing the motion of the said comet.

June 26. Mr. HOOKE produced a new kind of speaking trumpet figured bell-wise, repercussing and by degrees dilating itself; which being tried, and compared with that of Mr. CONVERS, was found to exceed it.

It was ordered, that against the next meeting, a pipe of the form of an ordinary trumpet should be made, widening by degrees in the form of a cone cut off, furnished with a mouth-piece.

Dr. GREW shewed again in the microscope the figure of the pith of a common thistle, and that of the tracheæ, or spiral fibres, of a burdock; of both which he had made a draught.

He was desired to endeavour to discover, whether, whilst plants are growing, there be a peristaltic motion in them, as MALPIGHI thought there is; and for that purpose to take some of the bigger sort of plants, wherein, if there be any such motion, it is more likely to be found.

Mr. OLDENBURG presented from Mr. BOYLE his *Essay about the origin and virtues of gems*, printed at London, 1672, in 8vo.

Dr. WALTER NEEDHAM produced a letter to him from Mr. TEMPLER, dated March 30, 1671², concerning the structure of the lungs, which from several experiments seemed to him to be a complication of a multitude of the ramifications of the bronchiæ and sanguineous vessels, &c.

This gave occasion to discourse of respiration, and of the principal use thereof, which Mr. HOOKE said he thought to be, that by the air something essential to life might be conveyed into the blood; and something that was noisome to it, be discharged back into the air: and he wished, that means might be used to discover, whether there are not valves in the arteries, by which the air may pass into all the parts of the blood. For which purpose it was suggested, that an injection might be made into those vessels, and particularly into some artery, with melted bees wax, mixed with tallow, and coloured, thereby to make the vessels

¹ Letter book, vol. v. p. 265.

² It is printed in the *Philosophical Transactions*, vol. vii. n^o 86. p. 5031, for August, 1672.

appear round and full, to see what might be farther discovered in their structure. This was recommended to the physicians of the Society.

Mr. OLDENBURG produced and read a letter to him from Signor CASSINI, dated at Paris, 22d June, 1672, N. S. *, containing his thanks to the Society for having elected him into their body; and accompanied with a written paper of two sheets in folio, giving an account of his endeavour for settling an hypothesis of the motion of Jupiter and his satellites.

This paper was committed to the perusal and consideration of Mr. HOOKE, who was desired to make a report of it to the Society at their next meeting, especially as the author expressed his desire of having the sense of the Society, or some members thereof, upon the said paper.

July 3. Dr. GREW was put in mind to see, what might be discovered of the peristaltic motion in plants, asserted by Signor MALPIGHI.

Mr. HOOKE was called upon for making a report concerning Signor CASSINI's paper concerning the satellites of Jupiter, and desired to give in writing what he had said upon it, that it might be without mistake imparted to Signor CASSINI, who had desired that favour in his letter.

The speaking trumpet ordered to be prepared for this meeting not being ready, Mr. HOOKE was ordered to take care of having it ready against the next.

Mr. OLDENBURG read three letters written to him, 1. from Signor MALPIGHI, dated at Bologna, 7th June, 1672 *, containing his sentiments of the ovaria and ova in women, asserted by Dr. de GRAAF and others, whose assertions he thought lightly probable

2. From Dr. SWAMMERDAM, dated 5th July, 1672, giving notice of an anatomical present of some parts of an human body, sent by him to the Society.

3. From Monf. HUYGENS, dated at Paris, 1st July, 1672 *, containing his thoughts upon Monf. SLUSIUS's last construction of the problem of ALHAZEN, with his own calculus of the same; as also concerning Mr. NEWTON's reflecting telescope, and applauding his new doctrine of light.

Mr. HOOKE upon occasion said, that he found, that a refracting object-glass collected more rays to a point than a reflecting one, both being of the same sphere. He was desired to shew this by an experiment.

July 10. Dr. GREW shewed the insertion of fibres running from the pith into the bark; the description of which he was desired to give in writing.

* Letter book, vol. v. p. 307.

* Letter-book, vol. v. p. 365.

* Ibid. p. 282.

Mr.

Mr. Hooke mentioned, that he had made a refracting object-glass upon the same sphere with a reflecting one, and found, that it represented the object brighter, of the same charge and the same aperture with a reflecting one.

He was desired to shew the experiment of it, by comparing two such glasses together, of the same sphere.

Mr. Hooke gave an account of Signor CASSINI's paper, concerning the system of Jupiter and his satellites, importing, that it was considerable, and deserved to have good notice taken of it in the observations of the motions of those stars.

The Society intending to make a recess for some time, the members were desired, that as many of them, as could conveniently, would meet on Fridays in the afternoon, at Gresham-college, to discourse of philosophical matters, and prosecute experiments; among which were recommended

1. Such, as might determine the queries lately sent by Mr. NEWTON to the Society, which involve his theory of light.
2. Such, as might improve Mr. NEWTON's reflecting telescope; and particularly to see finished a four-foot telescope of that kind, already recommended to Mr. COCK.
3. Such observations, as might confirm those of Signor MALPIGHI about the existence of certain tracheæ, or spiral fibres in vegetables, that contain air: as also to endeavour the finding out of that peristaltic motion, which the same author affirmed to have been observed by him in plants.

The Society was adjourned by the president, till such time as his lordship should find a competent number of members in town to meet again.

October 30. The Society began to meet again, after their recess since 10th July.

HENRY lord HOWARD of Castle-Rising was proposed by the lord bishop of Chester, and, on account of his quality, was immediately put to the ballot, and elected unanimously, and admitted.

THOMAS HOWARD, Esq; second son to the earl Marshall, was proposed candidate by the lord bishop of Chester.

Mr. ASHMOLE presented to the Society his *History of the Order of the Garter*.

[†] HENRY lord HOWARD was created earl of Norwich, and had, by the same patent, the grant of the office of earl Marshall, 29th October, 1672.

VOL. III.

I

There

There were also presented JOHANNIS HEVELII *Epistola de Cometa*, 1672, *mensæ Martio*.

MALPIGHI's *Dissertatio Epistolica de Formatione Pulli in Ovo*, Printed at London, 1672, in 4to.

MR. HOBBS's *Lux Mathematica Collisionibus* JOHANNIS WALISII. S. TH. D. & THOMÆ HOBBSII *Malmesburienfis excussa; multis & fulgentissimis aucta radiis, Auctore R. R. adjuncta conjura Doctrinæ Wallisianæ de Libra, una cum ROBERTO HOBBSII*. Printed at London, 1672, in 4to. And

JEREMIE HOROCII *Angli Opera Posthuma; una cum GARIÆ CRABTRÆI Observationibus Cælestibus; nec non JOH. FLAMSTEDII de Temporis Equatione Diatriba, numerisque Lancribus ad novum Lunæ Systema Horroecii*. Printed at London, 1672, in 4to.

It was ordered, that Mr. HEVELIUS, Signor MALPIGHI, and Mr. HOBBS should be thanked by the secretary for their respect to the Society, with an intimation that their books were committed to the perusal of some of the members.

The examination of what had been done concerning the queries of Mr. NEWTON, to be determined by experiments, concerning his theory of light, was referred to the next meeting.

An account being demanded of what trials had been made for the improvement of the reflecting telescope of Mr. NEWTON, Mr. HOOKE said, that hitherto he had wanted a mould of a sufficient bigness for a speculum, designed by him, of fifteen inches diameter, for a tube of ten feet long; but that he hoped to have, in a week or fortnight, such a mould cast, wherein a speculum of that bigness might be well wrought and polished.

Since during the Society's recess there had been communicated to the members, who then met at Greatham-college, Mons. HUYGENS's conjecture about the odd phenomenon of the mercury's standing top-full of well cleansed air, even to the height of seventy-five inches; and since the president and Dr. WALLIS had suggested divers experiments determining the cause of that effect; it was inquired what had been done in this matter? Mr. HOOKE answered, that some trials had been made about it; and that he would bring in an account of them in writing against the next meeting.

DR. GREW being called upon, for an account of the observations, which he had made in vegetables, produced a good number of such observations, made upon the roots of several plants, of which he exhibited the figures, both as the objects appeared to the naked eye, and by the microscope. He was desired to bring in a description of all these in writing, to be registred.

He was exhorted likewise to finish two or three plants, in all their parts, after this exact manner, to be printed early, before they were arrogated by strangers.

Two letters of Mr. LISTER to Mr. OLDENBURG, dated at York, one of the 10th of October, 1672, enlarging and correcting his former notes about kermes; and the other of 23d October, concerning land and fresh-water snails, with some queries relating to them, were read, and ordered to be inserted in the Letter-book.

November 6. Mr. THOMAS HOWARD of Norfolk was elected and admitted.

Mr. HOOKE read a discourse of his, containing his thoughts of the experiment of the quick-silver's standing top-full, and far above the height of twenty-nine inches; together with some experiments made by him, in order to determine the cause of this strange phenomenon. He was ordered to prepare those experiments for the view of the Society.

There was also read a letter of Dr. WALLIS to Mr. OLDENBURG, dated at Oxford October 25th, 1672*, suggesting divers experiments for the elucidation of the same phenomenon: which letter was delivered to Mr. HOOKE.

Two other letters were likewise read, both written by Mr. HEVELIUS to Mr. OLDENBURG from Dantzick, dated September 16, and October 29, 1672, concerning the eclipse of the sun, on the 11th of August, N. S. and the phasis of Saturn on the 19th of October: as also the re-appearance of the new star in the neck of the Swan*.

Mr. HOOKE produced two books, one intitled, *Ottonis de GUERICKE Experimenta nova Magdeburgica de vacuo spacio, &c.* printed at Amsterdam, 1672, in fol. and Dr. MORHUFF's *Epistola de Scypho vitreo per certum humane Vocis sonum rupto*, moving, that they might be bought by the Society for their libraries; which was agreed to.

He mentioned, that among Mr. GUERICKE's experiments there was one which he thought deserved to be tried before the Society, viz. that of a sulphur-ball having a considerable attractive power, and representing the properties of the earth.

Mr. LOCKE intimated, that himself had made some experiments with such a ball, and promised, that he would bring it to the Society at the next meeting.

* Vol. v. p. 348 and 351. The former of these letters is printed in the *Philosoph. Transact.* vol. vii. n.º 87. p. 5059.

* Letter-book, vol. v. p. 389. An abstract of

this and other letters of Dr. WALLIS's on that subject is, printed in the *Philosoph. Transact.* n.º 91. p. 5160, for February, 1673.

Letter-book, vol. v. p. 356.

There were read two letters more to Mr. OLDENBURG, the one from Mr. HENSCHAW, dated at Copenhagen, July 6, 1672^c, concerning his care of the philosophical concerns of the Society in Denmark, and giving some account of OLAUS WORMIUS's book, *De Mure Norvegica*; the other of Dr. ERASMUS BARTHOLIN, dated likewise at Copenhagen, 4th August, 1672^d, giving an account of the performances of Monf. PICART, the Parisian astronomer, in Denmark, and particularly in the isle of Huenna, &c.

Mr. TOWNLEY's figure, representing a thermometrical experiment of his, made at a considerable depth under ground, was ordered to be drawn large by the amanuensis, against the next meeting.

November 13. At a meeting of the COUNCIL were present,

The president,
The lord viscount STAFFORD,
Mr. AERSKINE,
Sir ROBERT MORAY,
Sir PAUL NEILE,

Sir THEODORE de VAUX,
Dr. GODDARD,
Mr. COLWALL,
Mr. OLDENBURGH.

A committee of the council, for auditing the treasurer's accounts, was appointed, consisting of the president, Sir THEODORE de VAUX, Dr. GODDARD, Dr. WALTER NEEDHAM, and Mr. OLDENBURG.

It was ordered, that the treasurer pay quarterly all the salaries payable by the Society till further orders: and that what copies of Signor MALPIGHI's dissertation *De Formatione Pulli in Ovo*, the printer would not furnish for the author gratis, should be paid for by the Society, who had lately ordered thirty copies of it to be sent to him to Bologna.

At a meeting of the SOCIETY the same day,

Sir ROBERT MORAY presented to the Society, for the repository, a bee-hive of a peculiar contrivance, sent out of Scotland by Sir WILLIAM THOMSON, made up of several pieces, to take off one; whereby bees are kept from swarming, by adding a new box for every swarm.

The experiment about the high suspension of quick-silver being called for, it was found, that it had failed. It was ordered, that thicker glasses should be provided for the next meeting.

Mr. HOOKE having made a report concerning the experiments suggested by the president and Dr. WALLIS, it was ordered, that the president's experiments not being rightly made, nor that of Monf. HUYGENS with a syphon, they should both be made before the Society, as soon as possible:

^c Letter-book, vol. v. p. 292.

^d Ibid. p. 367.

Mr. Hooke proposed a method of making the same experiment with a syphon in the open air, by double pipes, and by blowing them both into one ball. This was desired to make use of this contrivance.

Mr. Locke being called upon for his sulphur-ball, which he promised at the last meeting to produce at this, excused himself, that he had forgot it, promising to bring it at the next.

Mr. Hooke suggested, that it were worth trying, whether air be consumed, or increased by burning. He was desired to devise some experiments for determining this question.

Mr. Boyle moved, that it might be tried, to make air of finer bodies than ordinary, such as are distilled liquors, or chemical salts in distilled liquors, in order to find, whether or no such air will be more compressed by force than common air.

He moved also, that it might be examined, whether, in making salt-petre by art, there is any air intercepted and compressed.

November 20. A committee was nominated and chosen for auditing the accounts, consisting of Sir JOHN LOWTHER, Mr. HOSKYNs, Mr. Hooke, Mr. HILL, and Mr. LOCKE; of whom three were to be a quorum. They agreed to meet at Arundel-house on that day se'nnight, some time before the sitting of the Society.

An attempt was made of an experiment to discover, whether there be any air generated or consumed by burning, or neither: which not succeeding, it was thought proper, that it should be tried on the Saturday following, at Mr. Hooke's lodgings in Gresham-college, before such members of the Society, as used to meet there, and the success of it reported to the next public meeting.

An experiment was made, to shew, that water in a tube, open at both ends, will, when lifted up, stand at eight inches, before it begins to fall. Mr. Hooke was desired to describe the contrivance of this experiment, to be registred.

Three letters to Mr. OLDENBURG were read;

1. Of Mr. FLAMSTEAD, dated at Derby, 17th November, 1672, accompanied with his calculations of the appulses of the moon and the other planets to fix stars, for the year 1673*.

* They are printed in the Philosoph. Transact. vol. vii. n^o. 89. p. 5118. for Decem. 1672.

2. Of Mr. LISTER, dated at York, 15th November, 1672¹, concerning an uncommon kind of mushroom, yielding a milky juice, much hotter upon the tongue than pepper.

3. Of Monf. John HECKER, an astronomer of Dantzick, dated there 20th September, 1672², expressing a singular esteem of the institution of the Society, and intimating his having sent a written paper about a conjunction of Mercury with the sun; which paper had not yet been received.

The president suggested upon occasion, that Mr. HEVELIUS should be asked, when Mr. OLDENBURG wrote to him, whether he did not use a telescope with his quadrants and sextants in lieu of lights?

It was moved, that Mr. LISTER might be desired to send to the Society his opinion of the veins in plants, which he seemed willing to impart at the end of his letter of the 15th of November, in these words³: "The season is almost over, so that the account, which we can give of the veins in plants, must rest as it is, until farther opportunity. My sense of these veins, according to the experience I have yet of them, you may command. But what I chiefly aimed at, I have found exceeding difficult to effect; that is, an ocular demonstration of them: yet, in some measure, I have attained to that also."

Mr. HOOKE intimated, that the great tool for grinding the reflecting glass was now ready; and he was exhorted to put it to the trial, and to report the success to the Society.

November 27. At a meeting of the COUNCIL were present

Sir ROBERT MORAY, vice-president,	
The earl Marshal,	Sir THEODORE de VAUX,
The lord viscount STAFFORD,	Mr. COLWALL,
Mr. AERSKINE,	Mr. CREED,
Sir PAUL NEILE,	Mr. OLDENBURG.

The committee of the council for auditing the treasurer's accounts made the following report:

"At a committee of the council of the Royal Society for auditing the treasurer's accounts, November 23, 1672, upon examination of Mr. DANIEL COLWALL's accounts we find he is debtor,

¹ Letter-book, vol. v. p. 395. It is printed in the *Philosoph. Transact.* n° 89. p. 5116.

² Letter-book, vol. v. p. 340.

³ They are omitted in the copy printed in the *Philosoph. Transact.*

"To

1672.] ROYAL SOCIETY OF LONDON.

63

	<i>l.</i>	<i>s.</i>	<i>d.</i>
" To the arrears due to the said Society for their quarterly payments this 23d November, 1672	1957	12	0
" To monies he hath received for admissions	20	15	0
" To the balance of his last account	10	10	6
	£. 1988	17	6

" We also find he is creditor

" By monies he hath paid for the use of the Society, as by vouchers doth appear	163	1	3
" By arrears yet unpaid by the fellows of the Society	1818	7	0
" By balance resting in cash in his hand	7	9	3
	£. 1988	17	6

The council finding the vast arrears of many fellows of the Society, ordered, that once again a list should be drawn up by the amanuensis of those, who are most behind in payment; and that thereupon such persons should be solicited to pay by those, who had proposed them for candidates: and that this should be done against the next meeting of the council.

At a meeting of the SOCIETY on the same day, Mr. BOYLE produced a ball of sulphur melted in a glass ball, which, like electrical bodies, attracted several light substances, as also filings of fine copper. He shewed, that feathers being first attracted by this sulphur ball would leave this electrical body, and pass to one not electrical, untouched, as to a glass-phial.

Mr. HOOKE produced and read a discourse of his own, containing divers optical trials made by himself, which seemed to discover some new properties of light, and to exhibit several phenomena, in his opinion not ascribable to reflection, or refraction, or any other till then known property of light.

He was desired to pursue these experiments in a convenient season, and to deliver in to the Society some account of what was done on this subject, to be registered, to preserve his discoveries from being usurped.

He made an experiment to find out, whether air increases or decreases by burning: but the success not proving satisfactory, he was desired to repeat the experiment at the next meeting.

He being called upon concerning the large tool for grinding the reflex glass, said, that he had tried the said tool so far, as to find it pretty just.

Mr.

Mr. BOYLE upon occasion moved, that some true naphtha might be procured, to see, whether it would burn under water, he having found, that what is commonly brought to England for naphtha, does not so.

November 30. The report of the committee of the Society for auditing the accounts was made as follows :

“ At a committee of the Royal Society for auditing the treasurer’s accounts,
November 27, 1672,

“ We find Mr. DANIEL COLWALL, the treasurer, debtor,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
“ To monies he hath received on the quarterly payments of the } “ Society from 21st November, 1671, to 23d November, 1672, }	139	5	0
“ To money he hath received for admissions - - -	20	15	0
“ To balance of his last account of 21st November, 1671, - - -	10	10	6
	£ 170 10 6		

“ We also find he is creditor,

“ By monies he hath paid for the use of the Society, as his } “ vouchers make appear, - - - - - }	168	1	3
“ By balance resting in his hands - - - - -	7	9	3
	£ 170 10 6		

“ J. LOWTHER,
“ JOHN HOSKYNs,

“ A. HILL,
“ ROBERT HOOKE.”

The Society then proceeded to the election of a new council and officer, and there were continued of the council these eleven ;

The Lord Visc. Brouncker,
The Earl Marshal,
The Lord Visc. Stafford,
The Lord Bishop of Salisbury,
The Lord Berkley,
Mr. Aerskine,

Sir ROBERT MORAY,
Sir PAUL NEILE,
Dr. GODDARD,
Mr. COLWALL,
Mr. OLDENBURG.

The ten members of the council were,

The Earl of Dorset,
Mr. CHARLES HOWARD,
Sir JOHN LOWTHER,
Mr. EVELYN,
Mr. HILL,

Mr. HOSKYNs,
Mr. PEPYS,
Dr. ARDERNE,
Dr. CROUNE,
Mr. LOCKE.

For

For officers were chosen

The Lord Viscount Brouncker,
President,
Mr. Colwall, Treasurer,

Mr. Evelyn
and
Mr. Oldenburg } Secretaries.

Of ten new members of the council were present and sworn,

The Earl of Dorset,
Mr. Charles Howard,
Sir John Lowther,
Mr. Hill,

Mr. Hoskyns,
Mr. Pepys,
Dr. Arderne,
Dr. Croune.

Between this and the preceding anniversary election, the Society had lost three of its eminent members, MATTHEW WREN, Esq; FRANCIS WILLUGHBY, Esq; and JOHN WILKINS, D. D. lord bishop of Chester.

MATTHEW WREN, Esq; eldest son of Dr. MATTHEW WREN, bishop of Ely, was born August 20, 1629, in Peter-House, 'Cambridge', of which his father was then master. His first education was in that university, whence he removed to that of Oxford, where he was a student, not in a college or hall, but in a private house¹. In 1657 he published at London, in 8vo, *Considerations on Mr. Harrington's Commonwealth of Oceana*, restrained to the first part of the Preliminaries. Mr. HARRINGTON answered this discourse in the first book of his *Prærogative of Popular Government*, printed at London in 1658, 4to, in which he reflects on Mr. WREN as one of those virtuosi, who then met at Dr. WILKINS's lodgings at Wadham-College, the seminary of the Royal Society, and describes them as an assembly of men, who had an excellent faculty of magnifying a fault, and diminishing a commonwealth. Mr. WREN replied, in his *Monarchy asserted: or, The State of monarchical and popular Government, in vindication of the Considerations on Mr. Harrington's Oceana*; printed at London, 1659, in 8vo. Mr. HARRINGTON's rejoinder was an indecent piece of buffoonry, unworthy of his character, intitled *Politicks: or, a Comical Discourse in answer to Mr. WREN's book intitled Monarchy asserted*, &c. London, 1659, in 4to. Sir EDWARD HYDE, in 1659, was very solicitous, that Mr. WREN would undertake an answer to Mr. HOBBS's *Leviathan*².

At the restoration he was elected burgess of St. Michael in Cornwall to serve in the parliament, which began at Westminster, May 8, 1661, and was appointed secretary to the Earl of CLARENDON, lord high chancellor of England, who visiting the university of Oxford, of which he was chancellor, in September 1661, Mr. WREN was created there master of arts. He was one of the first members of the Society, when they began their weekly meetings at London, in

¹ Bishop WREN's larger Diary, printed in the *Paratitula: or Memorials of the Lives of MATTHEW WREN, bishop of Ely, &c.*
² Wood, *Fasti Oxon.* vol. ii. col. 143.

¹ Appendix to the Life of Dr. BARWICK. Letters of Sir EDWARD HYDE, of June 27, and July 25, 1659.

1660. After the fall of his patron, the Earl of CLARENDON, he became secretary to JAMES Duke of YORK, in whose service he continued till his death, about the 11th of June, 1672. His body was interred in the same vault with that of his father, in the chapel of Pembroke-hall at Cambridge.

FRANCIS WILLUGHBY, Esq; was descended of two very ancient families, both WILLUGHBYS, the one honourable, that of Eresby in Lancashire, by the father's side; the other worshipful, that of WILLUGHBY on the Wolds in Nottinghamshire, on the mother's *. He was only son of Sir FRANCIS WILLUGHBY, knight, by the lady CASSANDRIA, daughter of THOMAS RIDGWAY, earl of Londonderry in Ireland, and was born about the year 1637 *. His education was at Trinity-college in Cambridge, under Dr. JAMES DUPORT, afterwards dean of Peterborough, who dedicated to him and to Mr. EDWARD CECIL, Mr. JOHN KNATCH-HALL and Mr. HENRY PUCKERING, his *Hemeri Gnomologia*, printed at Cambridge in 1660, in 4to. In September, 1660, he resided at Oxford for the sake of the publick library *. On the 20th of November the year following, he was propoed candidate of the Royal Society by Dr. WILKINS, and being elected, was admitted on the 11th of December. He set out on his travels abroad in April, 1663, in company with NATHANIEL BACON, Esq; and Mr. RAY, and visited the Low Countries, Germany, Italy, France, and Spain, to which last country he went in August, 1664, his account of his travels there being printed at the end of those of Mr. RAY in 1673. While he was young, his relations discovered in him most excellent gifts and abilities both of body and mind; and therefore nothing was spared by them to promote and enlarge them; and with these he enjoyed the advantage of a plentiful estate, to which he succeeded in 1665, on the death of his father. He had been from his childhood addicted to study; and when he came to the use of reason he was so frugal of his time, that he did not willingly lose, or let slip unemployed, the least part of it, detesting no vice more than idleness, which he looked upon as the parent and nurse of almost all others. And his application to his studies, without any intermission or diversion, was thought by most of his friends to have impaired his health. He attained very great skill in all parts of learning, even those of the most abstruse kind, especially mathematical; in which science he corresponded with his incomparable friend Dr. ISAAC BARROW, two of whose letters to him are published *. His knowledge of natural philosophy, and particularly the history of animals, was superior to that of most of his age: and his moral qualities of modesty, sobriety, justice, and generosity, were no less eminent than his intellectual ones. He died July 3, 1672, aged 37 years, and left, by his wife EMMA, daughter of Sir HENRY BERNARD, knight, two sons, FRANCIS, and THOMAS, afterwards created a baronet 7th April 1677; and in January, 1711, lord MIDDLETON; and a daughter, CASSANDRA, second wife to JAMES duke of CHANDOS. His writings, besides these printed in the *Philosophical Transactions*, are *Ornithologie libri tres*, in quibus aves omnes hactenus cognita in methodum naturis suis convenientem redacta accurate

* Mr. RAY's preface to Mr. WILLUGHBY's *Ornithology*, London, 1678, folio.

* He was 37 years old at his death in 1672.

* Wood, Fasti Oxon. vol. 2. col. 119.

* *Philosophical Letters* of Mr. RAY, &c. p. 360, 362.

deseri-

describuntur, descriptiones iconibus elegantissimis, & vicarum acrim similis, et incisus illustrantur: London, 1676, in folio, revised, corrected, and digested into order by Mr. JOHN RAY, who afterwards translated it into English, and published it with an appendix, at London, in 1678.

De Historia piscium libri quatuor, jussu & sumptibus Societatis Regiæ, Londini editi. Tolum opus recognovit, coaptavit, supplevit, librum etiam primum & secundum integros adiecit Joannes Raines Societate Regiæ. Oxford, 1686, folio.

JOHN WILKINS, D. D. lord bishop of Chester, son of Mr. WALTER WILKINS, citizen and goldsmith of Oxford, was born at Fawkesly near Daventry in Northamptonshire, in the house of his mother's father, Mr. JOHN DOD, the celebrated puritan minister, about the year 1614¹. Having been educated in grammar learning under Mr. EDWARD SYLVESTER, who taught a private school in Allsaints parish in Oxford, he was entered a student in New-inn, in Easter term, 1627; and after a short stay there was removed to Magdalen-hall, under the tuition of Mr. JOHN TOMES², and as a member thereof, October 20, 1631, took the degree of bachelor of arts³, and, June 11, 1634, that of master⁴. Upon entering into holy orders, he became chaplain to WILLIAM lord viscount SAY and SELE, and afterwards to CHARLES elector Palatine, with whom he continued for some time. In 1638 he published at London, in 8vo. his *Discovery of a new World: or a Discourse tending to prove, that it is probable there may be another habitable World in the Moon; to which was added, a Discourse concerning the possibility of a passage to the World in the Moon*. In 1640, another performance of his was printed at London, in 8vo. under the title of *a Discourse concerning a new planet; tending to prove, that it is probable our Earth is one of the Planets*. These three discourses were published without his name. His next work was printed at London, 1641, in 8vo. and intitled *Mercury: or the secret Messenger, shewing how a man may with privacy and speed communicate his thoughts to a Friend at any Distance*. In 1646 he published at London, in 8vo. his *Ecclesiastes: or Discourse of the Gift of preaching, as it falls under the rules of art; and in 1648, his Mathematical Magic: or the Wonders, that may be performed by mechanical Geometry*, London, in 8vo. Having, after the breaking out of the war between king CHARLES I. and the parliament, taken the covenant, he was, April 13, 1648, made warden of Wadham College in Oxford, in the room of Dr. JOHN PITT ejected by their authority, having been the day before created bachelor of divinity⁵, as he was doctor, December 18, 1649⁶. The same year he published at London in 12mo. his *Discourse concerning the Beauty of Providence in all the rugged passages of it; and, in 1653, at London, in 8vo. his Discourse concerning the Gift of Prayer, shewing what it is, wherein it consists, and how far it is attainable by industry, &c.* About the year 1656, he married ROBIN, sister of the protector, OLIVER CROMWELL, and widow of Dr. PETER FRENCH, canon of Christ church; which marriage being contrary to the statutes of Wadham College, which prohibited the warden from marrying, he obtained a dispensation from the protector⁷.

¹ Mr. Wood. Athen. Oxon. vol. ii. col. 505.

² Id. ibid. says, that he was 13 years of age in 1627.

³ Id. Fasti Oxon. vol. i. col. 252.

⁴ Id. ibid. col. 260.

⁵ Id. Athen. Oxon. vol. ii. col. 505.

⁶ Id. Fasti Oxon. vol. ii. col. 91.

to hold the wardenship notwithstanding. In the beginning of 1659, by the favour of RICHARD CROMWELL, the protector, he was preferred to the mastership of Trinity college in Cambridge, on the death of Dr. JOHN ARROWSMITH. But being ejected thence the year following about the time of king CHARLES II's restoration, he became preacher to the honourable society of Grey's Inn⁷, and rector of Cranford in Middlesex, December 10, 1661⁸, in the room of Dr. THOMAS FULLER, deceased, to which living Dr. WILKINS was presented by GEORGE lord BERKLEY; as he was, April 11, 1662, to the vicarage of St. Laurence Jury in the city of London, by the king, on the promotion of Dr. SETH WARD to the bishopric of Exeter⁹. March 11, 1663, he resigned the rectory of Cranford, and was afterwards promoted to the deanry of Rippon in Yorkshire, and made prebendary of Chamberlain-wood in the cathedral of St. Paul's, March 26, 1667¹⁰. His excellent *Essay towards a real Chvraster and a philosophical Language* was printed at London 1668, in folio, with a dedication to the Royal Society. The same year he was advanced to the bishopric of Chester, to which he was consecrated, November 15. He had been one of that assembly of learned men, who met as early as 1645, and continued their meetings at London and Oxford, till they were formed into the Royal Society, of which he was nominated in the charter one of the two secretaries, and held that office till his promotion to the bishopric of Chester. He died of the stone at the house of Dr. TILLOTSON in Chancery-lane, who married his wife's daughter, on the 19th of November, 1672, and was interred on the 12th of December following under the north wall of the chancel of the church of St. Laurence-jury, where his funeral sermon was preached by his learned friend, Dr. WILLIAM LOYD, dean of Bangor, in which the bishop's character is represented in a strong and beautiful light. By his last will he left a legacy of two hundred pounds to the Royal Society, and his papers to Dr. TILLOTSON, who published from them a discourse of the *Principles and Duties of natural Religion*, printed at London, 1675, in 8vo. and a volume of *sermons*, fifteen in number, printed there in 1682, in 8vo.

December 4. The experiment to find, whether air increases or decreases, being called for, Mr. HOOKE affirmed, that he had found, that it neither increased nor decreased. A trial of this being made before the Society, it miscarried, and was therefore ordered to be repeated at the next meeting.

Mr. OLDENBURG produced and read a letter to him from Mr. LISTER, dated at York, November 30, 1672, concerning veins and other curious observables in plants, and particularly of the liableness of all vegetable juices to be frozen, except the milky one.

It was ordered to be entered into the Letter-book¹¹, and to be communicated to Dr. GREW for his perusal and consideration, who was desired to bring in his

⁷ Id. Athen. Oxon. ubi supra.

⁸ It is 1663 in NEWCOMB's Repertorium. vol. i. p. 596: but that must be a mistake, since that rectory was not vacant till Dr. THO-

FULLER's death, on the 5th of August, 1661.

⁹ Ibid. p. 387.

¹⁰ Ibid. p. 136.

¹¹ Letter-book, vol. v. p. 397.

remarks

remarks upon the same, and particularly to try in a convenient season the freezing^s of vegetable juices.

Mr. HOOKE being called upon about the giving in the heads of his late discourse concerning some new properties of light to be registered, promised, that upon farther prosecution of that subject he would bring in the whole.

He gave hopes likewise, that he might be able to bring in the large reflex speculum at the next meeting.

December 11. Dr. GREW brought in his remarks upon Mr. LISTER's letter of November 30, 1672, concerning the veins in plants; which remarks were ordered to be entered into the Letter-book *, and to be formed into queries to be communicated to Mr. LISTER for his farther consideration.

Mr. SCHROTER produced two letters in Latin to the Society, delivered to him lately in Germany, by one Dr. SALOMON REISEL, archiater to FREDERIC CASIMIR count of Hanaw, the one dated 30th September, the other 1st October, 1672; the former containing a relation concerning many capital letters found in both sides of a piece of beech-tree, cleft asunder, between the pith and bark; the latter discoursing about some vulgar errors. Which letters were ordered to be entered in the Letter-book *.

Mr. SCHROTER shewed the Society a human skull every where very curiously overgrown with moss; as also two telescopes made in Germany, one of which consisting of two tubes connected, and lying parallel to one another, was to serve both eyes at once, yet so as to represent the object single. Mon^r. SCHROTER was desired to bring them again to the next meeting, that they might be viewed by daylight.

December 18. At a meeting of the COUNCIL were present,

The president,
The lord viscount STAFFORD,
Mr. CHARLES HOWARD,
Sir JOHN LOWTHER,
Sir PAUL NEILE,
Mr. HILL,

Mr. COLWALL,
Dr. GODDARD,
Dr. CROUNE,
Mr. PEPYS,
Mr. LOCKE,
Mr. OLDENBURG.

Mr. LOCKE was sworn as one of the council.

Mr. OLDENBURG mentioning Dr. GREW's desire to be informed, whether the Society would farther employ him in the anatomy of plants upon the former terms, it was declared that the council and Society well approved of what he

* Vol. v. p. 405.

* Ibid. p. 415. & 418.

had hitherto performed; and that the council would farther recommend him to the Society, to continue him another year, if the subscribers would please to continue their contributions.

Sir PAUL NEILE representing to the council the strange neglect of Chelsea-college, and the reproaches thence falling on the Society, it was referred to Sir ROBERT MORAY, Sir PAUL NEILE, Dr. CROUNE, and any others of the council, who had opportunity, to discourse with Dr. WREN, the surveyor-general, and others, about letting out the said college to be built for a certain number of years.

It was ordered likewise, that Mr. HOSKYNs should be desired to satisfy the council about the nature of the land belonging to Chelsea-college, viz. whether it be Lammas-ground or not?

Sir PAUL NEILE moved anew, that considering the vast arrears due to the Society, the fellows thereof might by a legal tie be obliged to payment: and it being resolved, that as good council, as could be had, should be advised with, whether the obligation already subscribed by the fellows did not amount to such a legal tie? the lord viscount STAFFORD offered, that he would undertake to inquire accordingly of the best lawyers, whom he knew, and thereupon satisfy this council at their next meeting.

His lordship's offer was accepted, with thanks, and Mr. OLDENBURG was ordered to cause a copy to be made of the said obligation; and also of the statutes concerning the payments in general terms included in that obligation, and to send that copy to his lordship.

The amanuensis was ordered to go to the prerogative-court, and to copy out of the last will of the late Dr WILKINS, bishop of Chester, what the legacy is, which he had bequeathed to the Society.

The council declared, that in the absence of the president and vice-president at the public meetings, the members present shall nominate some of their number to take the chair.

December 18. Mr. HOOKE, the curator being absent, by reason of sickness, there were no experiments made at this meeting.

A letter of Mons. SLUSIUS to Mr. OLDENBURG, dated at Liege, December 6, 1672¹, in answer to one of Mr. OLDENBURG's of November 11. was read², concerning the optical problem of ALZAHEN; as also the suspension of purged quick-silver at seventy five inches.

¹ Vol. v. p. 407.

² Ibid. p. 359.

Mr. OLDENBURG produced an anatomical present to the Society from Dr. SWAMMERDAM, physician at Amsterdam, consisting of the following particulars :

1. An *uterus humanus*, prepared after the method of Dr. SWAMMERDAM, with all the other parts dried up, and the vessels filled with yellow and red wax, very distinctly injected, after the manner described by the doctor, in his book accompanying his present, intituled, *De uteri muliebris fabrica*, dedicated to the Society.

2. *Pudendum Virgineum, cum Hymene.*

3. *Chloridis Portiuncula.*

4. *Penis & Urethra Portiuncula.*

5. *Urethra Portiuncula.*

6. *Intestini jejuni Valvula conniventes, a RUYSCHIO observata, a KERCKRINGIO delineata.*

7. *Intestini Rojae cochlea, a STENONE descripta.*

8. *Lymphaticum peculiare ex abdomine Gallinae.*

9. *Arteria primi generis, seu pulmonalis in Piscibus, per quam sanguis ad branchias amandatur.*

10. *Arteria secundi generis in Piscibus, per quam sanguis e ramis branchialibus immediate per totum Corpus distribuitur.*

11. *Humani Lienis Arteria & Vena.*

12. *Insignes Arteria Hepatica Rami una cum Vescicula fellea.*

13. *Arteria Lienis vitulini.*

The Society being well-pleased with this present, ordered Mr. OLDENBURG, to write a letter to Dr. SWAMMERDAM^a, and to return him their solemn thanks, and to signify to him their high sense of his regard, shewn to them by so valuable a present.

The Society adjourned to January 8 following, on account of the ensuing festival.

^a Mr. OLDENBURG's letter to Dr. SWAMMERDAM, in Latin, dated at London, 19th December, 1672, is entered in the Letter-book, vol. v. p. 414.

1673, January 8. The *Philosophical Transactions* for December, 1672, containing the predictions of Mr. FLAMSTEAD of the apuluses of the moon to the fixed stars for the year 1673, were delivered to Mr. Hooke, in order that those apuluses might be observed.

Mr. OLDENBURG read a letter to himself from Dr. FRANCIS de la BOE SYLVIVS, dated at Leyden, 27 September, 1672, having been long detained by the person, who had been intrusted with it. It contained his request of the Society's judgment, concerning his *Praxeos Medicæ Idea Nova*. It was ordered to be entered in the Letter-book¹.

Mr. OLDENBURG presented likewise a copy of the second edition of Dr. SYLVIVS's *Idea Medicinæ Practicæ*.

There was produced to the Society a discourse of Dr. GREW, concerning his whole design with respect to vegetables, and the means of effecting it. Part of this discourse was read, to the great satisfaction of the Society, who urged the publication of it²; and the rest was ordered to be read at the next meeting.

Mr. HOOKE was desired to prepare some experiments for the next meeting.

January 15. The second part of Dr. GREW's design concerning vegetables was read, and he received the thanks of the Society for his care of improving that part of natural philosophy, and was again encouraged to proceed to make it public.

The Society considering likewise, that this prosecution of the anatomy of plants was very suitable to their design, and that Dr. GREW was very fit to be farther employed therein, ordered, that Mr. COLLINS should be desired to attend the several subscribers for a contribution to this work, and from the Society recommend to them the continuance thereof.

Mr. OLDENBURG read a letter to him from Mr. HENSHAW, dated at Copenhagen, 12th December, 1672, containing his observations of some curiosities met with in that place, and expressions of his care, in recommending the queries for Iceland, and the isles of Fero.

January 22. Mr. COLWALL presented a mathematical book, in folio, being the work of GREGORY de SANCTO VINCENTIO *De Quadraturâ Circuli*.

Mr. HOOKE produced an essay of a reflecting objective speculum, being the segment of a sphere of thirty six feet, which he hoped, when perfectly polished, would perform as much as a refracting object-glass for an hundred feet tube. He was desired to see it brought to perfection.

¹ Vol. v. p. 382.

² It was published at London in 1673, in 8vo, under the title of *An Idea of a philosophical History*, propagated, &c.

Mr. BOYLE sent a liquor, which had the power of so hardening soft bread in two or three minutes, that the bread made the glass, wherein it was held, ring when hit against it.

It was ordered, that he should be desired to inform the Society, what kind of liquor it was.

Mr. OLDENBURG produced a letter to himself from Signor MALPIGHI, dated at Bologna, 8th October, 1672¹, accompanying a discourse, containing his repeated observations upon eggs, whereby he partly confirmed and illustrated the former discourse, and communicated further discoveries on that subject.

At this meeting was present Monsr. LEIBNITZ, the author of the printed discourse, intitled, *Hypothesis Physica Nova*, dedicated by him in 1671 to the Society. He now shewed them a new arithmetical instrument, contrived, as he said, by himself, to perform mechanically all the operations of arithmetic with certainty and expedition, and particularly, multiplication, after such a manner, that a whole series of numbers, to be multiplied by other numbers, might be multiplied, if the multiplier be one number, by only one turn of the wheels of the machine; and if there be two numbers multiplicands, the operation shall be dispatched by two turns, and the addition of the two products performed at the same time, and so on. And as for division, that might be performed by determining the quotient without dividing.

He gave some proof of what he said, but acknowledged the instrument to be imperfect, which he promised to get perfected, as soon as he should be returned to Paris, where he had appointed a workman for it, whom he would order to make also a complete one for the service of the Society, who returned him thanks for these expressions of his respect and generosity.

January 29. Mr. BOYLE being made acquainted with the Society's desire, of knowing what liquor it was, which he had sent to the last meeting, and which had hardened soft bread, said, that it was fixt nitre resolved *per deliquium*.

He was thanked for this communication; as also for another, which was a method of producing a colour by two limpid liquors mingled together, and that without precipitation; and of destroying the colour thus produced, without precipitation; of which he now shewed the experiment with the desired success.

He intimated, that this experiment might conduce to the clearing of the doctrine of diaphaneity and opacity.

He took occasion to inform the Society, that he had lately seen a piece of an osier-tree, which he had taken for a piece of whale-bone, both for blackness and bending: it was found in a little rocky uninhabited island near Barbadoes.

¹ Letter-book, vol. v. p. 422.

Mr. OLDENBURG read the following letters :

1. Of Dr. BEAL, inclosing one from Mr. BUCKLAND of Somersfetshire, dated December 30, 1672, concerning a strange frost or freezing rain, which had lately destroyed abundance of orchards in the country about Bristol^a.

2. Of Monf. SLUSIUS, dated at Liege, 17th January, 167 $\frac{1}{2}$, N. S. containing his short and easy method of drawing tangents to all geometric curves, without the labour of calculation^b.

3. Of Dr. SWAMMERDAM, dated at Amsterdam, 24th January, 167 $\frac{1}{2}$ ^c, acknowledging the receipt of Mr. OLDENBURG's letter of thanks from the Society, for the Dr.'s late anatomical present, and communicating some new discoveries made by himself in anatomy, viz.

1. Of some animals, which have lungs, and yet naturally want a *vena arteriosa*.
2. Of the testicles of *Scurabæus nesi-cornis*, that they exactly agree in their structure with those of a man, and do *ex unico, tantum funiculo longo, curvo, innumeraliter flexo, atque (quod nondum, says he, in homine mihi visum est) in principio seu apice suo cæco, consistere*.

Mr. OLDENBURG was ordered, 1. To desire Monf. SLUSIUS to impart likewise his demonstration of his method of tangents. 2. To desire Dr. SWAMMERDAM to acquaint the Society, what animals they be, wherein he had found the *vena arteriosa* wanting.

Mr. BOYLE mentioned, that in a man executed some years before, the *foramen ovale* had been found open.

It was remarked hereupon, that the anatomical examination of amphibious creatures might make some good discoveries; and that therefore the physicians of the Society would do a considerable service to anatomy, if they would examine such animals more carefully than had been hitherto done.

Mr. HOOKE mentioned, that the reflecting speculum, which he had produced at the last meeting, was farther published; and that he would endeavour to get it finished in a short time.

February 5. Mr. HOOKE produced again his objective speculum for the reflecting telescope, which he affirmed to be now true, though not perfectly polished; which he would procure to be done against the next meeting.

^a It is entered in the Letter-book, vol. vi. p. 2. and published in the Philosoph. Transact. vol. vii. n° 40. for January, 167 $\frac{1}{2}$. p. 5138.

^b Letter-book, vol. vi. p. 11. It is published

in the Philosoph. Transact. vol. vii. n° 90. p. 5143.

^c Letter-book, vol. vi. p. 25. Part of this letter is printed in the Philosoph. Transact. vol. viii. n° 94. p. 6041. for May, 1673.

He mentioned, that he intended to have an arithmetical engine made, which should perform all the operations of arithmetic, with great expedition and certainty, without making use of the rhabdology, and that much more simply than that of Monf. LEIBNITZ, produced before the Society on the 22d of January. He was encouraged to make good his proposition.

Mr. OLDENBURG produced a register of observations, concerning winds and weather, left with him by Monf. LEIBNITZ, by whom it had been brought from Paris, where the observations had been made with an instrument called OTTO GUERICKE's *little man*; which is a tube kept in that city by Monf. DALANCE, containing a matter, which was held a secret by the author, who pretended by it to prognosticate the winds and their force ten or twelve hours before they blew; as also fair and rainy weather. It was added, that by this register, marking the several stations of the liquor, the signification, and the event, it appeared, that for the most part the event had answered the prediction, though sometimes it had failed.

This gave occasion to speak of the weather-cock so often mentioned formerly, and so desirable and useful: and it was ordered, that Mr. HOOKER do not fail to get such a clock made as soon as possible; especially since in France, Italy, and Germany, the curious were known to be ready to join their observations on the weather to those made by the members of the Society. Mr. HOOKER proposed to take care of this immediately.

Occasion being given to speak of petrifications, it was remarked by Mr. HOOKER, that he was credibly informed, that there was a ground in Bedfordshire, which would in a twelvemonth's time turn wood and other matter, that was not stony, into stone, without vitiating the figure.

This was confirmed by Sir ROBERT MORAY, who added, that the king had expressed his intention of buying that ground, and walling it about, on purpose to make in it experiments touching petrification.

It was wished, that his majesty, when there should be a proper opportunity, might be put in mind thereof, to command it to be done.

Sir ROBERT MORAY presented a centre fish-petrified.

Mr. OLDENBURG produced some yellow amber, and a piece of *lignum fossilis*, given him by Mr. HENSHAW's clerk, Mr. TRIBOLET, lately arrived from Copenhagen, near which city it had been digged out of the ground, at the distance of three or four hundred paces from the sea. Mr. HOOKER declared his opinion, that yellow amber was nothing but resin petrified.

It was ordered, that Mr. HOOKER's objective speculum should be again produced and tried at the next meeting.

February 12. being Ash-wednesday, the Society did not meet.

February 19. There was presented to the Society, from the East-India company, the whole skin of a musk-deer; for which the thanks of the Society were returned by the messenger who brought it. And the vice-president, Sir ROBERT MORAY, was desired to express, upon occasion, to the governor of that company, Sir JOHN BANKS, the great sense, which the Society had of their favour and kindness, in increasing the stock of their philosophical store-house with so rare a present; which was delivered to Mr. HOOKE for the repository.

Mr. OLDENBURG delivered likewise to Mr. HOOKE Dr. SWAMMERDAM's treatise, intitled, *Uteri muliebris Fabrica, una cum Methodo nova Cavitationis Corporis ita præparandi, ut suam semper genuinam faciem servent*: printed at London, 1672, in 4to, and presented to the Society by the author.

Mr. OLDENBURG presented also to the Society, from Signor FRANCISCO REDI, two books, the one printed at Florence, in 4to, intitled, *Esperienze intorno alla Generazione degli Insetti, fatte da Franç. Redi*; the other more lately published under the title of *Esperienze intorno a diverse cose naturali*, printed at Florence, 1671, in 4to. Thanks were ordered to be returned to the author, as also to Mr. DODDINGTON, for his care in bringing these books with him out of Italy. The latter of them was delivered to Mr. OLDENBURG, in order to make an extract of it, to be exhibited at the next meeting.

Mr. BOYLE presented a branch of a willow or osier-tree, which he had made mention at the meeting of January 29, 1672, that it was found in a small rocky uninhabited island near Barbadoes, and was like whalebone for blackness and bending.

Mr. OLDENBURG produced and read a letter in Latin, left with him by Monf. LEIBNITZ, dated at London, 1st 2nd February, 1672¹, containing his desire of being received into the Society, and his engagement of serving them to the utmost of his power, in promoting the design of their institution.

This gentleman having been lately present at several meetings of the Society, and at one of them having produced and shewed an ingenious arithmetical engine, and in other respects given testimony of his abilities, and of his great esteem for the Society, Sir ROBERT MORAY having taken public notice hereof proposed him as candidate.

Mr. HOOKE tried again the experiment formerly attempted, of finding, whether air increases or decreases by burning: but it miscarrying again, he was desired to fit it better for the next meeting.

Mr. REID of Herefordshire having sent some red-streak grafts for the service

of the Society, it was ordered, that such members, as had occasion to propagate this cider-fruit, should take their several proportion of these grafts.

There was produced a Bononian stone, which Mr. DODINGTON brought out of Italy and delivered to the secretary for the Society, and which was said to have been duly prepared for shining.

It was ordered, that at the next meeting this stone should be produced again, to make trial of its shining, there being now no sun for such a trial.

Mr. OLDENBURG produced several copies of Monf. HECKERUS's printed admonition to astronomers, *De mercurii in solem incurfu*: which copies were, according to the author's desire, distributed among the members of the Society.

February 26. The Society did not meet.

March 5. EDWARD BERNARD B. D. professor of Astronomy in the university of Oxford, was proposed candidate by Mr. OLDENBURG.

Mr. HOOKE made an attempt again of the trial to find, whether air is generated or consumed by burning; but the apparatus failing again, he was ordered to fix it with care.

He produced his arithmetical engine, mentioned by him in the meeting of 5th February, and shewed the manner of its operation, which was applauded. He was desired to bring in the description of it, that so it might the better appear how it differed from that of Monf. LEIBNITZ, produced January 22. before the Society.

Mr. OLDENBURG gave an account of part of Signor REDI's book, intitled, *Experienze intorno a diverse cose naturali*; wherein occurred some particulars, thought not inconsiderable: as 1. Of waters distilled in a leaden bell, rendering all sorts of natural waters turbid, when infused on them, except the conduit water of Pisa, which yet admits of a caution. 2. Of waters distilled in glass, sometimes growing troubled when mingled with waters distilled in lead, sometimes not. 3. Of cinnamon-water, which distilled in glass, and kept in glass, remains clear; but kept in crystal of Pisa grows turbid in a few hours, and milky, and in a few days yellow and bitter, though in crystal of Rome and Venice it does not become turbid till after two or three days; in crystal of Paris, not till after a much longer time. 4. Of the torpedo, stupifying only when touched and squeezed, not at a distance; together with a curious account of that fish dissected.

Sir ROBERT MORAY presented a pear grown out of a pear, each having a stalk of its own.

Mr. HOOKE promised to give the Society, at their next meeting, a lecture upon his weather-clock.

March 12. Mr. HOOKE read a discourse of his upon the weather-clock; which being but a part of the whole intended by him, he promised to bring in the remainder, containing the description of the engine, at the next meeting.

He was desired to take care, that such an engine be made with speed.

Mr. OLDENBURG produced two papers, one of which was from EZRAEL TONGUE, D. D. about a way of multiplying divers sorts of trees, with speed, by tongue-grafting (as he calls it) their roots, and by covering the places so grafted with earth, about two inches deep. The other was a letter from Mr. RICHARD REED, dated 27th February, 1677, at Lugwardene in Herefordshire¹, concerning two queries about planting, 1. Whether, in planting, the roots are to be set again at large, or pruned near to the trunk or body of the tree. 2. Whether early or late planting, both as to the living, and also the future thriving of the tree, be to be preferred; all benefits and inconveniencies of both seasons being considered? Mr. REED declaring for planting with little root, and for planting in February and March rather than before winter, and giving reasons for both.

There was presented an human skull, altogether and very curiously overgrown with very fine moss, which was said to have grown since it was brought over, in a chamber of Monsr. SCHROTER, who presented it, having procured it in Germany.

There was read a Latin letter of Dr. JOHN BAPTISTA GORNIA, physician to the grand duke of Tuscany, dated at Florence, 3d January, 1677, and written to Sir THEODORE de VAUX, containing the writer's opinion concerning the disease, of which Dr. WILKINS bishop of Chester died.

Mr. OLDENBURG presented the seventh volume of the *Philosophical Transactions*.

March 19. Mr. HOOKE read a discourse of his, giving an account of the success of this experiment, which, he said, he had made, about the increase or diminution of air by burning; which was, that the air was diminished one twentieth part.

He was desired to prosecute these experiments, and to give the Society an account of them from time to time, and to bespeak some members of the Society to assist at them.

He was put in mind to prosecute the invention of the weather-clock, and to hasten the making of it; and not to forget the finishing of the reflecting speculum.

¹ Letter-book, vol. vi. p. 51.

Mr. OLDENBURG read a letter to himself from Dr. SWAMMERDAM, dated at Amsterdam 24th March, 1673¹; giving an account of and naming the animals, which have lungs, and yet want a *vena arteriosa*; as also a description of the structure of the genitals of a *scarabeus nasicornis*.

1673, March 26. Mr. HOOKE made an experiment of mingling oil of vitriol and common water together, thereby shewing, that these two liquors were so incorporated, by entering into the pores of one another, that they took up less room, when mingled together, than they did both being apart. Of the common water there were twenty-one measures; of the oil of vitriol three measures, which is twenty-four measures in all, and yet mixt together they made but twenty-three measures.

Mr. OLDENBURG read two letters, one to himself from Signor CASSINI, dated at Paris 25th March, 1673, N. S. presenting to the Society his observations of two new planets moving about Saturn, the one within the *satelles* of Monf. HUYGENS, and therefore by the discoverer called *intimus*, making its periodical revolution about four days and an half; the other without the Huygenian *sateller*, and therefore called *extimus*, finishing its course in about eighty days².

The other letter was from Mr. GREGORY to Mr. COLLINS, dated at St. Andrew's, March 7, 1673, about the effects of oblique reflection above those of the direct; as also concerning the charges and apertures of telescopes with convex or concave speculums, and of his notion concerning burning concaves, &c. This letter was as follows:

"I have received yours, dated February 20. together with Mr. NEWTON's answer, with which I am exceedingly satisfied. I am much engaged to you both, for the pains you have been at; I am almost convinced, that oblique reflection causeth more light than the direct; but I am not fully persuaded, that it is more regular. I conceive, that the rudely polished plate of metal, in an oblique position, causeth the image appear more different, because the obliquity hideth the concavities, so that no rays come to the eyes, but from the tops of the little tubercula, which are certainly best polished; the other rays, which confused the image, being kept away: but if the plate be exactly polished (I speak here as to sense) the position must be so oblique, before the insensible concavities can be hid, that the planes fall always even, to the sight, in a line, I grant, I have been mistaken in that first advantage, which I mentioned; for the plane speculum F, having certainly (as all human artifice hath) some errors in it, causeth greater prejudice by them, being remote from the focus, than being near to it, and in it there is none at all caused; where if it could be placed, and a near and direct aspect had of it, this were certainly the best telescope of this sort.

¹ Letter-book, vol. vi. p. 57. Part of this letter is printed in the Philosoph. Transact. vol. viii. for May, 1673. n° 94. p. 6041.

² Letter-book, vol. vi. p. 69.

³ See Philosoph. Transact. vol. viii. n° 92. p. 5178. for March, 1673.

"It

" It is true indeed, that in telescopes with convex or concave speculums to double the charge, the length must be almost doubled; but to double is a great alteration, and hardly sufferable (as I suppose) in very good glasses, if the least charge be considerable: but I understand not how the charge can be altered at all, with the same glasses, in Mr. NEWTON's telescopes; for I know nothing of that, which was described to Mr. OLDENBURG. It is true, that the eye-glasses can be changed in all telescopes, if they be at hand of the required depth. I think, there is no great hazard in these telescopes of overcharging, seeing the charge of the glass can be diminished at pleasure; neither upon this account needs the angle of vision be so small, seeing it is equal to the angle of the eye-glass from its focus, its other focus being the little speculum; nor the darkness at all augmented, if the aperture of the speculum be proportional to the diameters of the spheres.

" But above all things, I desire to know this, that seeing the image made by the great speculum may be esteemed a small visible, and seeing Mr. NEWTON in *Transactions*, p. 3080, thinketh it fitter to make a microscope or tube to behold a small visible of one concave speculum and one eye-glass, rather than with one single eye-glass, and much rather than with one plane speculum and with one eye glass: wherefore also to look to this small visible, the first also should not be preferred to the last. This image indeed is not capable of such magnification as a visible is; yet I am hardly sensible, how this should cast the balance, taking in the defects of a plane speculum, together with other inconveniencies in taking up this object. I said indeed, that hyperbolic and elliptic glasses were tried in vain; but I spake not so of spheric speculums (as Mr. NEWTON's words seem to imply, *Transact.* p. 4059;) for any thing I did, deserves not the name of a trial, seeing Mr. REEVE and Mr. COCK both know, that the great speculum was polished only with a cloth and putty; neither, the truth is, thought it worth the pains, at that time, to be serious about further inquiry in that business; for they undertook indeed to polish a less speculum to me upon the tool. I am not yet fully convinced, which of these two ways have the best advantage, albeit I incline more to Mr. NEWTON's, especially because of the small distance betwixt the plane speculum, focus and the eye; however, experience must determine all; neither am I concerned how it happen. I had no intention, that my thoughts of these telescopes should be printed: my design was only before, as now, that, if you thought fit, otherwise not, you might send them to Mr. NEWTON.

" I received those letters you mention, as also that box, together with the things contained, and particularly Horrox's Posthuma, for which I must acknowledge myself exceedingly engaged to you. I have perused him, and am satisfied with him; it was a great loss, that he died so young.

" Mr. NEWTON's discourse of reflection puts me in mind of a notion I had of burning-glasses several years ago, which appears to me more useful than subtle: if there be a concave speculum of glass, the leaden convex surface having the same center with the concave; or, to speak precisely, albeit perchance to little
" more

" more purpose, let the radius of the concavity be c , the thickness of the glass in
 " axis transitum f , the radius of the convexity equal to $\frac{90^3 + 18cf + 5f^2}{9c + 5f}$; this
 " speculum shall have the foci of both the surfaces in the same point; and not only
 " that, but all the rays, which are reflected betwixt the two surfaces, shall in their
 " egress come quam maxime to the common focus. The making of such a speculum
 " requireth not much more art than ordinary plane glass, seeing great subtilty is not
 " necessary here; so that, I believe, they, who make the plane mirror glasses, would
 " make one of these three foot in diameter for four or five pounds sterling, or little
 " more; for I have seen plane glasses, almost of that bigness, sold even here for less
 " money. Now seeing (as Mr. NEWTON observeth) that all reflecting metals lose
 " more than one third of the rays, this concave glass, even *ceteris paribus*, would
 " have a great advantage of the metalline one; for certainly an exactly polished
 " thin mirror glass, of good transparent matter, after a few reflections, doth not
 " lose one fourth of the rays; and upon other accounts this hath incomparable
 " advantages; seeing it is more portable, free from tarnishing, and above all
 " hardly one twentieth part of the value.

" The great usefulness of burning concaves, this being so obvious, and yet (for
 " that I know) untouched by any, makes me jealous, that there may be in the
 " practice some fallacy. You may communicate this to intelligent persons, and
 " especially to Mr. NEWTON.

" P. S. If you please, let me hear with the first convenience, what may be
 " judged the result of this burning concave; for I am as much concerned to be
 " undeceived, if there be any insuperable difficulty, as to be informed of a most
 " surprising success. I have spoke of it to several here, but all were as ignorant
 " of it as myself. Several months by-past I have been so much busied in some
 " private studies, that I have forgot to pay my respects to you, which otherwise
 " my inclinations lead me to, upon which account I am more tedious now than
 " at other times. I desire yet to be more particular in the matter of telescopes;
 " I suppose a four foot telescope to have the aperture of six inches; the little con-
 " cave having the aperture of three fourths of an inch may magnify eight times,
 " the radius being one foot; in this case the hole in the middle of the great con-
 " cave is only three fourths of an inch, which being filled with an eye-glass, equal-
 " ly convex on both sides, amplifying the charge of the little concave twenty
 " four times, doth make a telescope magnify the object an hundred and ninety
 " two times, (which is no extraordinary charge, seeing Mr. NEWTON's table giv-
 " eth an hundred and seventy one and might be much less without inconvenience)
 " taking in an angle of vision of above twenty degrees, and with this there is
 " not lost one sixtieth part of the rays. With the loss of one thirty-sixth part of
 " the rays, it might magnify not above an hundred and forty four times and take
 " in an angle of vision of above twenty eight degrees. With all this the middle of
 " the object is illustrated with all the rays, which the aperture of the great concave
 " doth reflect. By these means, I think, that I keep off from those two incon-
 " veniences mentioned by Mr. NEWTON, in the seventh particular of his confide-
 " VOL. III. M rations.

"rations. The event of these other considerations, as I suppose, can only be determined exactly by experience."

It was ordered, that this letter should be communicated to Mr. NEWTON, as the person most concerned in it.

April 2. There was presented to the Society, from Mr. SAINT CROIX, his lately printed *Dialectica ad mentem JOHANNIS SCOTI eruta & elucidata*.

Mr. HOOKE made an experiment, by mixing oil of tartar and aquafortis together, to see how they would incorporate, and how much less space they would take up when thus incorporated than both apart. The mixture caused a great ebullition, which lasted all the while that the Society sat: but it ran over several times, and therefore Mr. HOOKE was desired to make it again.

Mr. OLDENBURG read a letter to himself from Mr. FLAMSTEAD, dated at Derby, 17th February, 1673¹, giving an account of his considerations upon Monf. HECKERUS's printed admonition, *De Mercurii in Solem Incurfu observando anno 1674, mense Maio*.

It was ordered, that Monf. HECKERUS be made acquainted with the contents of this letter.

Mr. OLDENBURG read an account of some observations made by the prince of Conde, near Paris, about a well belonging to the house of the marquis of St. SIMON, of a moderate depth, and making an extraordinary noise, when the weather is to change from fair to foul, and the greater the noise, the worse the weather will be; but none at all, when the weather is changing from foul to fair.

It was remarked, that an inquiry should be made, whether the well was a dry one, or had water in it, and what was peculiar or remarkable in the situation of it, or ground about it.

April 9. Mr. EDWARD BARNARD and Monf. LEIBNITZ were unanimously elected into the Society.

Mr. HOOKE made an experiment with aquafortis and a little piece of brass wire, put into that liquor, marking where the liquor stood before the putting in of the brass, and where, after it was put in: as also, how far it was raised upon its working upon the brass, and how low it descended afterwards, which was almost an inch below the mark, at which it stood at the first putting in of the brass.

He promised to bring in a full account in writing of this experiment, and of that made at the preceding meeting.

¹ Letter-book, vol. vi. p. 41.

Mr. OLDENBURG read a letter to himself from Monf. HUYGENS, dated at Paris, 14th January, 1672⁷, containing some considerations upon Mr. NEWTON's theory of light; together with Mr. NEWTON's answer to them, dated at Cambridge, 3d April, 1673².

Mr. OLDENBURG was desired to communicate this answer to Monf. HUYGENS.

He presented to the Society from Mr. BOYLE his new book intitled, *Tracts, containing new Experiments touching the Relation betwixt Flame and Air, and about Explosions, &c.* printed at London, 1672, in 8vo.

Mr. OLDENBURG gave notice, that Sir JOSEPH WILLIAMSON being to go to Aix la Chapelle, as one of his majesty's ambassadors, offered his service to the Society for inquiries after philosophical matters in those parts; and that himself, Mr. OLDENBURG, had already drawn up some directions and queries for that purpose.

This offer was accepted, and it was ordered, that Sir JOSEPH WILLIAMSON should be thanked, and the queries read; which being done, and some other particulars suggested by some of the members present, Mr. OLDENBURG was desired to digest and deliver them.

He read likewise a letter to himself from Dr. BEAL dated at Yeovil in Somersetshire, April 1673, recommending a certain pear, making an excellent drink, though the fruit be of so very disagreeable a taste, that even hungry swine would not eat of it.

Dr. BEAL was desired to procure some grafts of it for Mr. CHARLES HOWARD, who would yet venture at this season to ingraft them.

April 16. Mr. HOOKE being called upon for an experiment, and having none ready, he was ordered to prosecute those lately begun about the incorporation of liquors, and to bring in a written account of those, that had been hitherto made.

Sir ROBERT MORAY related an observation made of a liquor called *Goddard's drops*, exhaled in two years time to the half of it out of a glass hermetically sealed, belonging to the lord archbishop of Canterbury.

This was confirmed by the lord bishop of Salisbury, who added, that it was so well sealed up, that no smell at all could be perceived of the liquor within.

It was moved, that this glass might be desired of the archbishop for making further observations about it; and that, when obtained, it might be weighed, then

* Letter book, vol. vi. p. 17. Part of this letter is printed in the Philof. Transact. vol. viii. in the Philof. Transact. n^o 97. p. 618.
n^o 56. p. 6086. for July 1673.

broken, and immediately after weighed again, to find whether any considerable part of the liquor had been changed into vapours, and lodged in the empty part of the glass.

Mr. Hooke observed, that spiritous liquors, though well closed up, would in time commonly lose their virtue, and also their bulk, the particles of it passing into the pores of one another.

The president moved, that some of the same drops might be very carefully sealed up, and then immediately weighed exactly, and after some time weighed again.

Mr. OLDENBURG read a letter written to him by Dr. SWAMMERDAM, dated April 21, 1673, from Amsterdam⁷, accompanied with some anatomical observations of his about the pancreas and pancreatic juice of several fishes; as also of an human *fetus* lately found at Rome between the *ovarium* and the *tuba*, contained with its usual integuments; the description and delineation whereof, he intimated, were then preparing at Rome.

April 23. An experiment was made with aquafortis and pulverised oyster-shells in a bolt-head, tied close about at the open end with a flaccid bladder, in order to see, what it would produce; and it was found after a little while, that the bladder was swelled. It was then ordered, that it should be put, as it was, into the trunk of the Society, and left there, locked up till the next meeting, to see, whether these exhalations would prove permanent air.

Mr. BOYLE mentioned, that he had frequently made such kind of experiments, and thereby produced true air, which lasted for several months together.

Dr. CHAMBERLAYNE presented a piece of bark, which he said had been sent out of the East Indies to the lord HERBERT⁸, with this account, that it had been unseen and unknown in that very place from whence it was sent, and that some Indians had brought it thither, concealing the place where they had it. The scent and taste were very aromatical and pungent, especially those of the thin and innermost barks.

Dr. CHAMBERLAYNE was desired to request the lord HERBERT, that since he corresponded in the East Indies, he would endeavour to procure a greater quantity of it, and, if possible, an account of the place of its growth, it being very likely to be a very stomachic spice.

A letter of Mr. BERNARD, dated at Oxford, April 15, 1673⁹, returning to the Society his thanks for his election, was read.

⁷ Letter-book, vol. vi. p. 91.

⁸ CHARLES lord HERBERT, son of HENRY

marquis of Worcester.

⁹ Letter-book, vol. vi. p. 74.

There

There was produced a book belonging to Mr. HENSHAW, and sent by him to Mr. OLDENBURG, intitled, *Olaus Wormius de Mure Norvegico**, with the following relation prefixed to it in Mr. HENSHAW's own hand; "Memorandum, quod d. 14 Junii, 1672, excellentissimus dominus ULDRICUS FREDERICUS GULDENLOW, filius naturalis regis Daniæ, FRÉDÉRICI III. defuncti, prorex Norvagiæ, affirmavit mihi cum juramento, aliquando in Norvagia aliquos ex istis muribus, quos incolæ *Lemming* vocant, super galerum suum depluisse; quod ipsum & antea sibi accidisse ibidem mihi affirmaverat dominus CROUS, Telenorius regis Daniæ in Norvagia."

It was thought by some of the members, that supposing the matter of fact to be true, those animals must have been carried by some very violent wind from an high ground into the air, and so fallen down; it having been observed from the relations in this book of WORMIUS, that as soon as such animals had fallen down, there had been found in their bellies herbs yet undigested and corn; which could not be but that they must have been before in such places, where such herbs and grains grow.

April 30. The Society did not meet.

May 7. CHARLES lord HERBERT, eldest son of HENRY lord marquis of Worcester, was proposed candidate by Mr. HOSKYNs.

There was produced the bladder, which at the meeting of April 23, had been somewhat inflated with air produced by aquafortis and powdered oyster-shells, and now much more swelled than at that time.

It was moved, that it should be tried, whether this air thus produced would serve for burning; that is, whether a candle might be kept burning in it as in common air; and if so, whether for as long or a longer or shorter time: and that for this purpose this very air should be conveyed into another vessel, to burn bodies in it.

It was also ordered, that this experiment should be tried with a mixture of other bodies, to see whether air could be produced fit for respiration.

It was likewise moved, that it might be considered, whether the aquafortis be considerably wasted; or what quantity of it is raised up into air: for which end it would be necessary to weigh it exactly before it be put in; as also the oyster-shells.

Mr. Hooke remarked, that it would be worth trying, what effect precipitation would have upon air by pouring certain liquors upon solutions to make precipitations.

He read a paper of his concerning arithmetical instruments, as well those, that had been made upon the principle of the rhabdology, as that other shewn to the

Society, January 22, by Monsr. LEIBNITZ; and he promised one of his own invention of better performance. This paper was ordered to be register'd^b, as follows :

" The best way for addition and subtraction is by setting down the numbers on paper, and proceeding as in common arithmetic; both these operations being quicker and much more certainly done than by any instrument whatsoever : for, first, the numbers may be writ down in half the time they can be set on any instrument; and, secondly, they remaining altogether in view, may be quickly added or subtracted, and the sum or remainder set down; and if there should be any mistake in the first, they can be presently run over again (which is not a quarter part of the trouble of the operation) whereas by an instrument to examine an operation over again, the whole trouble of the operation is performed; and a man is much more subject to mis in putting the key into the right number, than he is in setting down the figure to express it; and therefore, for those kinds of operations in arithmetic, an instrument is wholly insignificant, and at best will come short of common counters.

" Next, the best instrument for squaring and cubing, or for extracting the square or cubic root, is by printed tables for that purpose, such as BABINGTON hath printed at the end of his fireworks, or Dr. PELL hath lately epitomised and reduced to a lesser volume : for by the help of printing a book of tables, which will presently resolve questions of that kind to twenty or thirty places, will be reduced into a less volume, and be purchased at a much cheaper rate than any arithmetic instrument, that shall do the whole operation itself without skill; and, if skill in arithmetic be allowed to be joined in the use of the instrument, printing will furnish us with tables, that will do all those kind of operations with much more certainty and speed, than any arithmetical instrument yet known.

" Thirdly, as to multiplication and division, the lord NEPER, in his Rhabdology, hath taught a very excellent facilitating method, by the help of small rods, which I take to be the plainest, shortest, and exactest method of using that help, much better than that of Monsr. PETIT, of putting them on a cylinder, or any other way of putting them on moveable wheels; that way taking up much less room, being more easily changed and varied, and being capable of the advantage of the press, which makes them much less chargeable and cumbersome, for they may be printed on parchment, and cut into strips, which may be afforded very cheap, will take up very little room, and they may be made use of to what number of places one will.

" Or, if one will avoid setting down the intermediate products, his compound rhabdology may be made use of, by printing those rods, or places, on parchment, both for the figures and holes, by the help of which there is no use of addition or setting down till last of all, or that the whole operation be completed.

^b Register, vol. iv. p. 17.

" As

"As for the arithmetical instrument, the model of which was produced here before this Society, it seemed to me so complicated with wheels, pinnions, cantrights, springs, screws, stops, and truckles, that I could not perceive it ever to be of any great use, especially common use: first, because the multitude of the parts must vastly augment the charge and bulk thereof; so that it could only be fit for great persons to purchase, and for great force to remove and manage, and for great wits to understand and comprehend: secondly, because the multitude of its parts must make it exceeding hard to be put into good order, and extraordinary apt to be put out of it; besides, I saw no means of examining, whether the operation had been truly performed, without trying it over again, which is intolerable. The design, indeed, is very good, which is the only thing I was able to understand of it, which is to give the product and quotient of a multiplication or division, which Sir SAMUEL MORLAND'S Instrument is not at all adapted to. But I have an instrument now making, which will perform the same effects with the German, which will not have a tenth part of the number of parts, and not take up a twentieth part of the room, that shall perform all the operations with the greatest ease and certainty imaginable; whereby in large numbers, for multiplication or division, one man may be able to do more than twenty by the common way of working arithmetic, and, that without at all troubling his memory or ratiocination, and this by two instruments quite differing in their principle and contrivances; the description of which I design to present to this honourable Society, after the model promised by Monsr. LEIBNITZ to be sent from Paris to this Society to be here seen and examined."

Dr. GREW produced several roots of plants, as avens, primrose, orchis, &c. to shew, that part of the trunk of those roots descends so, as that, which is root now, will rot off, and the superior part next to it will supply its place: whence he concluded, that there was a double motion made in the trunk of the root; the one for receiving the juice for nourishment: the other for shooting downwards.

This seeming to some members to be a kind of muscular motion, it was moved, that the structure of the root should be well examined.

Signor BOCCONE, a Sicilian gentleman, who was well skilled in plants and petrifications, being present at this meeting, produced a certain leafy stone, called by him, *lapis fossilis, bitumen redolens, in montibus Hybleis Siciliæ repertus*; as also a kind of *lapis bozear mineralis*, found likewise in the same island, and there used in powder against fevers with good success.

Sir ROBERT MORAY related from captain HERBERT, that about the islands of Majorca and Minorca they had found within a rock shell-fishes, good to eat, of the taste of muscles; and that he had taken abundance of them.

Farther, that in those parts he had seen lying on the surface of the sea a substance with motion, which being touched by him had retired within the water; but

but a little after appeared again above water. Whereupon his curiosity had moved him to approach nearer to it, and to take it up out of the sea; which done, he had found it to be a kind of a living worm putting itself out and in, fastened in a substance like a plant as in a sheath.

Mr. OLDENBURG produced a book of Dr. de GRAAF, dedicated to the Society, intitled, *Regneri de Graaf Partium Genitalium Defensio*, together with a letter to Mr. OLDENBURG, dated at Delft in Holland, 28th April, 1673*, communicating some microscopical observations of Mons. LEEWENHOECK†. The book was ordered to be examined by Dr. WALTER NEEDHAM, Dr. CROUNE, and Dr. KING, who were desired to give the Society an account of it.

Mr. OLDENBURG read a letter to himself from Mr. FLAMSTEAD, dated at Derby, 19th April, 1673, accompanied with a paper in Latin, containing some observations of his own about Jupiter's transit near some fixed stars*, useful for the determining its inclination to the ecliptic. These observations were recommended to the perusal of Mr. HOOKE.

Mr. HOOKE desired, that Sir SAMUEL MORLAND's book, intitled, *the Description and Use of two arithmetic Instruments*, &c. printed at London, 1673, 12mo. might be purchased for the Society's library; which was ordered to be done.

May 14. Mr. BOYLE produced a liquor of his own preparing, which, though cold, and made seven or eight months before, yet in a minute gave a yellowish tincture to a silver sixpence at first, which afterwards turned to a blackish colour: which experiment was several times repeated with the like success.

He being asked, what other metals it had this effect upon, said, that upon brass it did very well; not so well upon steel, much less upon tin.

Dr. WALTER NEEDHAM being called upon to make a report concerning Dr. de GRAAF's book dedicated to the Society, and referred at the last meeting to his consideration jointly with Dr. CROUNE and Dr. KING, said, that he had looked it over, but not yet communicated it to the other physicians; and that he had found in general, that in this book there was first a dispute between the author and Dr. SWAMMERDAM about the priority of the discovery of the *ovarium* & *ova* in viviparous animals, and then a charge against Dr. SWAMMERDAM of several errors in anatomy committed by him: that he, Dr. NEEDHAM, having compared this book with that of Dr. SWAMMERDAM, dedicated likewise to the Society, was of opinion, that, as to the dispute about the said discovery of eggs in viviparous animals, the readers must be referred to the times, when the several claimants of that discovery published their books about it, and thence left to judge of the

* Letter-book. vol. vi. p. 98.
† Printed in the Philos. Transact. vol. viii.
nº 94. p. 6037. for May 1673.

* Letter-book. vol. vi. p. 84. The letter and
observations are printed in the Philos. Transact.
vol. viii. nº 94. p. 6037.

priority contended for. But as to the errors, which these two authors charged upon each other, he was of opinion, that in some things Dr. de GRAAF was in the right, and mistaken in others, and *vice versa* Dr. SWAMMERDAM; and that it would require some time to examine the particulars, in the doing of which it would be requisite to make some observations to pronounce with the more certainty of these matters contested.

Dr. NEEDHAM received the thanks of the Society, and was desired to proceed to that particular examination, and to advise with the other two physicians in it, according to the order of the preceding meeting; which he promised to do.

Mr. HOOKE made an experiment with the air, produced 23d April, in a bladder by the operation of aquafortis upon oyster-shells, having first tried how long a slender white wax candle would burn with common air, which it did, in one glass, during the space of sometimes seventeen, sometimes twenty or twenty-one vibrations of a pendulum of about a second; in another bigger glass, during the space of 55 vibrations: whereas the factitious air, being by a certain contrivance squeezed out into the larger glass, yet so that some of the common air remained in it, the said wax-candle burnt in it only forty-five such vibrations.

This experiment being not accurate enough, Mr. HOOKE was desired to make another apparatus for a better trial.

It was moved again, that some experiments might be made to produce air fit for respiration; upon which occasion Mr. BOYLE suggested, that the trial might be made with coral and vinegar.

May 21. There were viewed several curiosities concerning corals and stones belonging to Signor BOCCONE; and it was ordered, that he should be thanked in the name of the Society for his respect and communications to them.

Three letters were read, one from Signor MALPIGHI to Mr. OLDENBURG, dated at Bologna, 10th May, 1673¹, signifying the continuance of his observations relating to the anatomy of plants; as also of his having seen statues and pictures shining in the dark with flaming blue and white colours.

The other two letters were from Mons. LEIBNITZ to Mr. OLDENBURG, dated at Paris, the former April $\frac{1}{2}$ ², the other May $\frac{1}{2}$ ³; both containing philosophical communications, and notice of his arithmetical engine being very near perfected.

May 28. The experiment of generating air with aquafortis and oyster-shells powdered was made again; which being done, and a wax candle having burnt on the common air of a glass vessel, sometimes thirty-seven, sometimes forty or forty-five vibrations of a pendulum of about three feet long, the same candle

¹ Letter book, vol. vi. p. 114.

² Ibid. p. 101.

³ Ibid. p. 115.

put in the vessel filled with the factitious air would not burn in it, but only an inch beneath the mouth of the glass, where the outward common air had some communication with the produced air; for, being put lower, it went out immediately upon several trials. It was observed, that the candle being gone out near the orifice, it would catch the flame again, when hastily drawn up close to the top. Besides, it was taken notice of, that when this factitious air was driven out of the vessel, the flaming candle held over it was presently blown out by it.

Mr. JOHN TEMPLER, an ingenious gentleman, come out of the country, and upon his desire admitted to be present at this meeting, produced a very fine bed of amethysts brought from the East Indies, wherein some stones of that kind were very regularly shaped, and well tinged; others yet untinged, which were supposed to have not yet been pervaded by the tinging juice.

Mr. HOSKYNs produced a piece of silver ore, lent him by captain BERTUE, who had brought it out of Sweden, where, he said, in the Swedish Silverberg, as he had been informed, they throw in coal over night into the rocky mine, and having let it burn and calcine all night, slake it the next day; whereupon the stony part being washed out of the ore by the water, the metal appears, as in this piece, in long, thick, silvery streaks.

Mr. OLDENBURG read a letter written to him by Mr. LISTER from York, 21st May, 1673¹, containing divers considerable particulars about very aged persons; sudden appearances of vast troops of insects; a strange quantity of divers sorts of worms found in the guts of dogs, and in the ulcerated ancle of a girl; the analogy betwixt the veins in plants and the nerves in animals: the actual passage of the chyle into the lacteal vessels; together with the experiments made by him upon that subject; the result of which was, that, notwithstanding all the injections made by him with tinged liquors into the guts of live animals, he could never find the least discolouring of the chyle on the other side of the guts, that is, within the lacteal veins; but always white and uniform.

It was ordered, that Mr. LISTER should be desired to continue such instructive experiments.

June 4. The lord HERBERT was elected into the Society.

Mr. HOOKE made an experiment with air produced out of bottled ale, putting it into a glass vessel, in order to see, whether, and how long, a candle would burn in it; and it was found, that it would no more burn in this air, than it did in air generated out of aquaortis and pounded oyster-shells.

It was proposed, that something might be thought upon for correcting this air, so as to make a candle burn or animals live in it.

¹ Letter book, vol. vi. p. 124. Part of it is printed in the Philosoph. Transact. vol. viii. n^o 93. p. 626o. for June 1673.

Mr. Hooke said, that he would confider of it, and try, whether it might be corrected by precipitation.

Sir ROBERT MORAY produced a paper, which was read, containing an account of some experiments made by Dr. WALTER NEEDHAM, and Mr. RICHARD WISEMAN, ferjeant chirurgeon, with the liquor sent out of France, where it was famous for stanching of blood in a little time, without any eschar, suppuration, or cicatrice*. It proved successful, though, in these trials, not in so short a time, as the Parisians said they had found it.

Sir ROBERT MORAY mentioned, that Sir SAMUEL MORLAND, bart. had given out, that he had invented a kind of a force-pump, which should perform better than other pumps hitherto used; that it should have no rubbing, but all impediments removed, and the whole strength applied; and, that the king had referred it to the consideration of the commissioners of the navy, in order to make use of this way in ships.

He related also, that Sir SAMUEL MORLAND had proposed a method of weighing anchors with ease and safety. Whereupon Mr. Hooke affirmed, that he had several years ago invented a convenient method of doing the same things, which having discoursed of somewhat in general, he was desired to acquaint the Society with the particulars at another meeting.

Dr. GREW shewed the company two microscopical observations upon a piece of fir, and another on oak-wood, a description of which he promised to communicate in writing.

JUNE 11. Dr. GREW shewed three microscopical observations; the first, upon a piece of a wild olive-wood transversely cut, in which the air-vessels were seen to go round about the inner edge of the bark in a circle: the second, upon a piece of vine, cut likewise transversely; wherein the air-vessels appeared to lie in a strait line between the bark and the pith, and larger and more numerous than in olive-wood: the third, upon a piece of fir-tree, cut length-wise, wherein the sap-vessels were observed to be so many tubes made up of divers fibres as clusters, and those stitched together with other fibres running horizontally.

Dr. GREW was desired to give an account of those observations in writing, and to prosecute them.

Mr. BOYLE proposed the observing. 1. What difference there is between the structure of fruit-bearing plants, and those that bear no fruit? 2. Whether there be any difference in the air-vessels of the same plant in winter and in summer? 3. Whether the vessels below and above in a plant differ considerably in bigness; and in what part of the plant they are biggest? 4. Whether in the root the vessels be considerably bigger than in the body of the tree? 5. Whether the

* This account is printed in the *Philos. Transact.* vol. viii. n^o 95. p. 6032. for June 1673.

parts of a graft after ingrafting do retain the same pores and figures of the air-vessels and sap-vessels, which they had before ingrafting, or upon the original tree: for instance, when an apricot is ingrafted upon a palm-tree, wherein, and in all other ingraftings, the sap, which passed through one sort of strainer, viz. that of the stock, passes now in the graft through another sort of strainer? 6. Since some grafts agree well with some stocks, and not with others, what difference there is in the several pores and vessels of such disagreeing plants? 7. The texture of all sorts of resinous trees.

Dr. GREW mentioned, that in resinous trees the air-vessels are very small and few, and the sap-vessels large, as in fir, cypress, &c. whereas in other trees, as in oak, the air vessels are very large, and the sap vessels strait.

Mr. OLDENBURG read a Latin letter to the Society from Mons. LEIBNITZ, dated at Paris, 1st June, 1673¹, giving them thanks for his election into their body.

Dr. WALTER NEEDHAM made an experiment of the French liquor for stanching of blood, upon a dog². He cut the crural artery quite cross with an incision-knife: the blood gushing out copiously, a lint dipped in the liquor, of which there was but a very small quantity, was applied to the wound, and held upon it a little while, when, by reason of the great glut of blood, that could not be well wiped away for want of a sponge, the lint was changed for a fresh one dipped in the remaining liquor, and kept on about half an hour, and being then let loose, the blood was found stanch'd: whereupon the dog being unbound, licked the wound, and walked away without any ligature, being committed to the care of Mr. HOOKE, to see, whether the wound would keep stanch.

JUNE 13. Dr. BISTER, a physician of Hamburg, was propos'd candidate by Mr. BOYLE.

Mr. BOYLE caus'd an experiment to be made with a liquor, which, though cold to sense, did, by its emitted fumes, in a minute, first through double, and then through four-fold paper, tinge a copper half-penny without tinging the paper interpos'd.

Mons. DENIS, a French physician, tried his blood-stanching liquor upon a dog³, whose crural artery was opened by making a wide oblique orifice in it, to which his liquor being applied and held to it by a compress, the blood was stanch'd in seven minutes, and the dog was let go in five and twenty minutes, without any ligature, the compress being fallen off.

The Society thought fit to intermit their meetings from this day till the president should summon them to meet again.

¹ Letter-book, vol. vi. p. 137.

² An account of this experiment is printed in the Philosoph. Transact. vol. viii. n^o 95. p. 6033.

³ An account of this experiment is printed in the Philosoph. Transact. n^o 95. p. 6053.

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October 9. At a meeting of the council were present,

The President,

The lord viscount STAFFORD,
Mr. CHARLES HOWARD,
Sir PAUL NEILE,
Sir JOHN LOWTHER,
Mr. PEPYS,

Mr. COLWALL,
Dr. CROUNE,
Mr. HILL,
Mr. OLDENBURG.

The president gave the council notice, that there had been lately with him a committee of the professors of Gresham College, and another of the Mercers company, inviting the Royal Society to return to that college, and to keep their assemblies there, as formerly they did before the fire. To whom he had returned his thanks for this kind offer, and for their respect to the Royal Society; adding, that he would acquaint the council with it at their next meeting.

This being reported, the council thought good to have their hearty thanks returned to the said committee for their kindness and respect, yet without saying any thing to them of acceptance or not acceptance; only, in case they should give occasion for saying more, that then it might be mentioned, that the business was under consideration.

The persons appointed to give these thanks were the lord viscount STAFFORD, Sir PAUL NEILE, Sir JOHN LOWTHER, Mr. PEPYS, Mr. COLWALL, Dr. CROUNE, and Mr. OLDENBURG, or any three of them.

Whilst this was doing, Sir THEODORE de VAUX came in, being sent by the earl of Norwich, earl marshal, to acquaint the council, that his lordship wondered, that they were not met in Arundel-house, as formerly, but yet hoped, that they would hereafter still continue their meetings there, as formerly; and that if they should remove to any other place, he could not but take it very unkindly.

Hereupon the president declared, that for this time he had caused the council to be summoned in this place for his particular convenience, his present occasions not having permitted him to go far off. And his lordship, at the desire of the council, returned their hearty thanks to the earl marshal for his singular affection and respect to the Society.

This being done, the president intimated, that it was time to call upon Dr. TILLOTSON, dean of Canterbury, as executor of Dr. WILKINS, bishop of Chester, for his legacy of four hundred pounds sterling, bequeathed to the Royal Society: Whereupon it was thought good by the council, that Mr. COLWALL and Mr. HILL should be desired to speak with the said dean about this matter at their first convenience.

Chelsea college being spoken of, and something mentioned of pulling down the house, and selling the materials, it was thought fit by the council,
HOSKYNs

HOSKYNs or some other lawyer should be consulted with, whether, notwithstanding the clause in the charter of non-alienation, the said house might be pulled down, and the materials sold.

Mr. OLDENBURG produced the report of the three physicians, Dr. CROUNE, Dr. NEEDHAM, and Dr. KING, concerning the anatomical controversies between Dr. SWAMMERDAM and Dr. de GRAAF, referred to the judgment of the Society; and he desired to know, whether the said report should be transmitted immediately to the persons concerned, or deferred till the Society should meet again.

It was thought proper to send it away by the first post, considering that it had been long deterred already.

N^o 97 of the Philosophical Transactions was licenced by the council.

October 22. At a meeting of the council were present

The president,
The Earl Marshal,
The lord viscount STAFFORD,
The lord bishop of Salisbury,
Mr. CHARLES HOWARD,
Sir JOHN LOWTHER,

Mr. PEPYS,
Mr. COLWALL,
Mr. HILL,
Mr. HOSKYNs,
Dr. CROUNE,
Mr. OLDENBURG.

The council considering the necessity of securing the weekly payments for carrying on the work of the Society, and having consulted the treasurer's book concerning the persons, that may be looked upon as good paymasters, they were found to be these:

- 1 The lord viscount BOUNCKER,
president,
- 2 The Earl Marshal,
- 3 The earl of Anglesey,
- 4 The earl of Devonshire,
- 5 The earl of Aylebury,
- 6 The lord viscount STAFFORD,
- 7 The lord bishop of Salisbury,
- 8 The lord bishop of Chester*,
- 9 The lord BERKLEY,
- 10 The lord BRERETON,
- 11 The lord HOWARD of Castle-
rising,
- 12 Mr. BOYLE,
- 13 Mr. AERSKINE,
- 14 Dr. ARDERNE,

- 15 Mr. ASHMOLE,
- 16 Sir JOHN BANKS,
- 17 Mr. BARRINGTON,
- 18 Mr. BROOKE,
- 19 Dr. BROWN,
- 20 Dr. COTTON,
- 21 Mr. COLWALL,
- 22 Dr. CHAMBERLAYNE.
- 23 Mr. CREED,
- 24 Mr. EVELYN,
- 25 Dr. GLISSON,
- 26 Dr. GODDARD,
- 27 Mr. HAAK,
- 28 Mr. HOOKE,
- 29 Mr. HILL,
- 30 Dr. HOLDER,

* JOHN PEARSON, D. D.

31 Mr. HOSKYNs,
 32 Mr. CHARLES HOWARD,
 33 Mr. EDWARD HOWARD,
 34 Mr. THOMAS HOWARD,
 35 Mr. HENSHAW,
 36 Mr. LE HUNT,
 37 Dr. KING,
 38 Mr. LOCKE,
 39 Sir JOHN LOWTHER,
 40 Mr. LISTER,
 41 Sir PAUL NEILE,
 42 Dr. WALTER NEEDHAM,
 43 Mr. OLDENBURG,
 44 Mr. PARKER,

45 Mr. PEPYS,
 46 Sir WILLIAM Petty,
 47 Mr. SMITH,
 48 Sir ROBERT SOUTHWELL,
 49 Dr. TILLOTSON,
 50 Sir THEODORE de VAUX,
 51 Dr. WALLIS,
 52 Dr. WARD,
 53 Sir JOHN WILLIAMS,
 54 Sir JOSEPH WILLIAMSON,
 55 Dr. CHRISTOPHER WREN,
 56 Sir CYRIL WYCHE,
 57 Mr. WYLDE.

This number being selected, there were some others found, whom the council thought fit to have asked, whether they were willing to comply with the new regulation of the Society, by paying their arrears, and by assuring their payments for the future : and they were these ;

Sir GEORGE ENT, Dr. THOMAS COX, Dr. WHISTLER, Dr. THRUSTON, Mr. NEWBURGH, Earl of Dorset, Earl of Yarmouth,	}	To be asked by Dr. CROUNE.
Mr. RICAUT, Mr. POVEY, Sir JAMES LONG, Dr. JAMES du MOULIN,		
Mr. THOMAS NEILE,		To be asked by Mr. HOSKINS.
Dr. WILLIS, Mr. SLINGSBY, Sir NICHOLAS STEWARD, Sir JAMES SHAEN, Lord viscount RANELAGH, Lord CLIFFORD,	}	To be asked by Mr. OLDENBURG.

The Earl Marshal proposed, that the absent in remote places might be considered.

The president suggested, that it was necessary to secure first of all the anniversary elections, at which there must be present thirty-one fellows ; and therefore such a number of fellows to be fixed, as might be likely to afford such a number of electors.

Clerk

October 30. At a meeting of the council were present

The lord bishop of Salisbury in the chair,	
The Earl Marshal,	Mr. HILL,
Mr. CHARLES HOWARD,	Mr. HOSKYNs,
Mr. COLWALL,	Mr. OLDENBURG.
Dr. GODDARD,	

The Earl Marshal reported, that the earl of Yarmouth had declared to him, that he would clear his arrears to the Society: and for Mr. POVEY, he had desired, that his account with the Society, for whose service in the business of the Savoy he had expended twenty pounds, might be stated; and that being done, he was willing to pay what should be due from him above that sum.

Hereupon Mr. OLDENBURG was ordered to search in the Council-book what was formerly ordered by the council in this matter.

Concerning Mr. RICAUT, the Earl Marshal offered to write to him to Smyrna about his arrears; and doubted not but they would be satisfied.

Upon this occasion of Mr. RICAUT's absence in remote parts, the Earl Marshal proposed, that such members of the Royal Society, as were abroad, or should go abroad, and continue absent from England above three months, should not be obliged to pay their weekly contribution after those three months were expired; but every such fellow should be left at his own liberty to pay or not after that time, till he should be returned to England.

This proposition was unanimously agreed to by the council.

It was also ordered, that the fellows, who were in arrears, should be allowed, if they made no present payment of them, to give a bond to the Society, to pay within, or at the end of, six months; and that Mr. HOSKYNs draw up a form for such a bond.

Memorandum. That when the number of the fellows, who were, or were to be, shall be agreed upon, the form of a legal tie be presented to every one of them to secure the weekly contributions.

It was mentioned, that as long as it was not known, how many would remain of those, who were now of the Society, the number of the ordinary fellows could not be fixed.

The Society this day resumed their weekly meetings.

Sir JUSTINIAN ISHAM, Bart. was proposed candidate by Dr. WALTER NEEDHAM.

Mr. HOOKE being called upon for experiments, and particularly concerning the weather-

weather-clock, said, that he would prepare some experiments for the next week, and take care of having the weather-clock made; as also of finishing his discourse upon it.

Dr. WALTER NEEDHAM presented for the repository a jaw-bone of a lamb, sent him by Mr. TEMPLER out of Northamptonshire, which had all its teeth discoloured with a brazen colour.

Mr. CHARLES HOWARD produced such another, which, he said, was brought out of Sicily, where it had been affirmed to him, that generally the sheep, which feed upon a certain mountain there, had teeth thus coloured.

Some of the members were of opinion, that this colour might proceed from herbs growing in such ground, as had underneath it copperas mines; others thought that it might be artificial.

Mr. OLDENBURG presented from Dr. HOBOKEN, a Dutch physician, his book, *De Anatomia secundine humane repetita & aucta*, printed at Utrecht in 1672; together with a letter from the author to Mr. OLDENBURG, dated 8th August, 1672, this letter and the book having been detained long in their way to England on account of the war.

Mr. OLDENBURG read likewise several other letters and papers, which came to his hands during the Society's recess, as

1. A paper in Latin, sent by Mr. HENSHAW from Copenhagen, in a letter, dated August 7, 1673¹, which paper contains the answers of one LUCAS JACOB DEBES chief minister in the isles of Fero, to divers queries formerly proposed to him².

The paper was as follows:

"Ad primas duodecim quaestiones, nihil in promptu est, ex Færois, quod respondetur: quoniam iis in terris aut nunquam aut raro intentum aliquod est frigus.

"R. 13. Fulgura & tonitrua accidunt ibi semper hyberno, nunquam æstivo tempore: circa halones & irides nihil singulare adhuc observavi. Ignes fatui nunquam ibi apparent.

"14. Frequentiores venti sunt Africus & Zephyrus, inprimis vere & autumn. Afferunt plerumque tempestatem pluviosam: hæc autem ventorum effecta sunt observata, quod sæpius ei plagæ, a qua fiat ventus, aërem afferant nubilosum; adverse autem serenum; id quod fieri existimem propter excelsos insularum montes, acris liberum motum impediētes.

¹ Letter-book, vol. vi. p. 228.

² Ibid. p. 229.

“ 16. Refractionem, nec non diametrum solis & lune, ortus vel occasus
 “ tempore, curioso non licuit observare, propter obstantia montium juga. Pleia-
 “ des omnes, quamvis obscuræ, conspiciuntur tamen cœlo sereno. Luna ple-
 “ rumque apparet tertio, interdum quarto, die a novilunio.

“ 17. Eclipses vix ibi possunt observari, propter aerem turbulentum, ea in
 “ plaga frequentissimum.

“ 18. De salis copia vix possum certo quid statuere; ego semel, necessitate
 “ adductus, ex viginti quatuor * * * aquarum marinarum dimidiam salis co-
 “ quendo mihi comparavi: mare tamen valde falsum esse indicio sunt multi ma-
 “ nipuli falsium, qui colliguntur in scopulis & rupibus, ubi æstas incidit calida
 “ & serena. Lucet quidem & micat mare noctu, sed non, nisi turbatur remis inter
 “ remigandum. Si de currentibus cæterisque maris affectibus eo spectantibus
 “ referrem, volumen conscriberem: quia vero de omnibus & singulis in libro meo,
 “ jam in lumen prodeunte, (qui Fœroæ, vel Fœroa referata inscribitur) fustus
 “ egi, ad eum curiosos remitto.

“ 19. Ex mineralibus saltem invenitur talcum, perexiguæ tamen quantita-
 “ tis; ex cæteris nihil.

“ 20. Magnetis variatio est 13 gr. 19 min. occidentem versus, uti observatum
 “ est anno 1659, die 25 Decembris.

“ 21. Ferrum opinione citius contrahit ferruginem, a qua ita arroditur, ut
 “ tenue ferrum intra paucos annos non sit usibus humanis.

“ 22. Nullæ feræ in Fœrois habentur, sed domestica tantum animalia: quæ-
 “ nam circa ea, nec non aves & pisces, sunt notanda, copiose in mea Færoa
 “ referata explicavi.

“ 23. Inter vegetabilia, hæc occurrunt notabilia; radix Rhodia, quæ alibi
 “ studio in hortis colitur, ibi ubertim sponte naturæ provenit, crescens super am-
 “ nibus & mari, in præruptis montibus & promontoriis, qua ancillæ utuntur ad
 “ capillos flavo colore tingendos: nec minor vis angelicarum nascitur in monti-
 “ bus, cœmeteriis, & hortis, quas incolæ non tantum in deliciis habent, sed cau-
 “ libus earum radicibusque coctis famem propulsant, incidente annonæ caritate.
 “ Tormentillarum incredibilis habetur copia, quarum radicibus, loco corticum,
 “ utuntur ad coria præparanda. Varia antiscorbutica ibi etiam inveniuntur; de
 “ cæteris nihil relatu dignum. De viribus herbarum inhabitatores parum sunt
 “ solliciti; olera varia ibi crescunt, quorum semina ex Dania afferuntur, quippe
 “ raro ad tantam maturitatem perveniunt, ut semina ferant, præter brassicam;
 “ cujus semen tandem degenerat in rapas. Ex frumentis tantum feri potest hor-
 “ deum; arbores nullæ crescunt præter juniperum super terram serpentem.

“ 24. Equi & oves brumali tempore semper sub dio vitam tolerant, quo-
 “ niam tam hyeme quam æstate aer est temperatus.

“ 25. Vac-

" 25. Vaccæ & equi sunt concolores cum aliis ejus generis in aliis regionibus :
 " ovium aliæ sunt albæ, aliæ nigre, aliæ rubræ, sed pro loci diversitate ; in bo-
 " realibus insulis pleræque albæ, in australibus autem nigre : ubi vero oves albæ
 " e borealibus insulis transferuntur in australes, pedetentim nigrescunt ; quo co-
 " lore inficiuntur primum circa pedes, dein circum femora, post sub ventre, de-
 " nique super dorso : utrum hæc nigredo proveniat ex terræ nitro an sulphure,
 " curiositatis magistrorum censuræ atque judicio submittitur.

" 26. Pestis & febris Foerois exulant ; interim affliguntur nonnulli lepra,
 " multi scorbuto, omnes catharro quotannis, vere ineunte. Ad scorbutum pel-
 " lendum, utuntur aut lacte solo recenti, aut cum cochleariis cocto. Ex catarrho
 " ita laborant, ut nonnulli sint morti vicini, morteque pauci interdum defun-
 " gantur ; adversum quem morbum serum lactis vetustum, sere servidum, bi-
 " bunt, idque felicissime. Alias confliguntur cum morbo quodam peculiari, quem
 " vocant Landfarfoot, febri militum castrensi non abssimili ; cui nullum adhibent
 " remedium, sed eventum Deo committunt, quo etiam medico plerique conva-
 " lescent.

" 27. Plumæ anatinæ, quas *Eiderdun* vocant, colliguntur ex certa quadam
 " ave marina, *Eider* nominata, quæ plumas illas ex proprio suo pectore, inter ex-
 " cludendos pullos, pro ovis fovendis evulsas in nido reliquit ; unde excerptæ
 " colliguntur ; quæ autem plumæ alio tempore vi evelluntur, propter pinguedinem
 " nulli sunt usui.

" 28. Monocerotes marini juxta littora Fœroarum nunquam visi sunt ; va-
 " ria alioquin genera Cetorum mare Fœroanum frequentant, quos inter certi ge-
 " neris Cetus incolis est maxime molestus, quem nuncupant Troidhual, ad quem
 " repellendum, aut castoreum, in carina cymbæ inclusum, servant, aut lignum
 " juniperinum in mare projiciunt, quorum, vel istius fœtorem vel hujus odo-
 " rem olfaciens ad imum subsidet."

2. A letter from Mr. HEVELIUS to Mr. OLDENBURG, dated August 23, 1673', together with the title page of his book, called, *Machina celestis pars prior, Organographiam Astronomicam exhibens, &c.* The letter intimated, that the second part of this work, containing all the author's celestial observations, was also in the press.

3. A letter of Mr. LISTER to Mr. OLDENBURG from York, dated 2d September, 1673', signifying his own invention of a blood-staunching liquor, at least as good and efficacious as that of Mons. DENYS, the French physician.

It was ordered, that Mr. LISTER should be desired to send to the Society, either a specimen of his water for stanching of blood, or the preparation of it.

Sir THEODORE de VAUX read a paper, containing a narrative of the case of a

* Letter-book, vol. vi. p. 225.

* Ibid. p. 263.

young woman, who had, according to the account of many credible witnesses, and his own examination, lived without food for several years. He was desired to give this account to be registered, which he promised to do.

November 6. At a meeting of the COUNCIL were present

The lord bishop of Salisbury in the chair,	
The earl marshal,	Mr. COLWALL,
The earl of Dorset,	Mr. HILL,
The lord visc. STAFFORD,	Mr. OLDENBURG.
Sir JOHN LOWTHER,	

Mr. OLDENBURG reported to the council, what he had found upon the council-book, concerning Mr. POVEY's business spoken of at the last meeting, viz. that 18th May, 1664, there was an order made, that the treasurer of the Society should reimburse to Mr. POVEY the expences, which he then alledged to have been at for the Society's service.

Whereupon it was ordered, that Mr. COLWALL should be desired to state Mr. POVEY's arrears due to the Society, and subduct from them the sum demanded by him, and receive from him the remainder of his arrears.

It was ordered also, that the treasurer of the Society, Mr. COLWALL, do send to such fellows of the Society, as were in arrears, to acquaint them with the new regulation, which the council is now making, for a firm establishment of the said Society: and that therefore the arrears due to the Society are to be forthwith collected; and also a legal obligation to be subscribed by as many as should desire to continue fellows, for the better securing the weekly contributions for the future. And that therefore every fellow being in arrears shall be desired by the treasurer either to send in, between this and St. Andrew's day next (being November 30, 1675) all his arrears, or at least to give a sufficient bond to pay the same within, or at the end of six months from the date of this order, and to declare withal, whether he will continue a member of the Society, and comply with the aforesaid subscription.

After this the earl marshal was acquainted by the council with their thoughts of removing their weekly assemblies to Gresham College, and of beginning to meet there again upon the next anniversary election-day; the council being moved thereunto, by considering the conveniency of making their experiments in the place where Mr. Hooker, their curator, dwells, and that the apparatus is at hand; as also by the solemn invitation of the city of London, and the professors of Gresham College; and likewise from the hopes, which they find grounds to entertain, of meeting with some considerable benefactors at that end of the city. To which was added, that though this Society should thus remove their meetings, yet they were full of hopes, that his lordship would be so far from removing his favours and kindnesses from them, that he would preserve them in the same degree he had done all along, and especially during the many years he had entertained them

them under his roof. To all which the council added this humble request, that the earl marshal would be pleased to give the council leave still to meet upon occasion in his lordship's house, there to enjoy the honour and advantage of his council and directions, which they had always found so affectionate and considerable to them.

Whereupon the earl marshal very obligingly and generously declared, that though he always had esteemed, and still did esteem it, a great honour to his house, that the Royal Society kept their assemblies there; yet understanding, that the council apprehended it really to be for the service and good of the Society to return to Gresham College, he could not but give up his reason to the reason of the council; adding further, that he should continue the same respect and concern for the Society, where-ever they met, and be glad to receive the council in his house upon any occasion of their meeting.

Which declaration of his lordship was so deeply repented by the council, that they unanimously desired the lord bishop of Salisbury, in their name, to give the earl marshal their very humble and hearty thanks for his extraordinary favour and bounty towards the Society, in receiving them so frankly and generously into his house, when upon the sad calamity of the fire of London they were destitute of a place of meeting; as also in entertaining them afterwards, for so many years together, with all the nobleness imaginable; superadding to all that his great munificence in giving them the Arundelian library, and heaping many other real expressions of generosity upon them. To which the council added this farther order, that the lord bishop of Salisbury should be desired to acquaint the Society itself, now ready to meet, with this whole matter, that they, concurring with the council in this affair, might present themselves in a body to the earl marshal, and make the like acknowledgments with the council; which was done accordingly, as appears by the entry in the Society's Journal-book upon this very day.

At a meeting of the SOCIETY on the same day,

JOHN STAFFORD HOWARD, Esq; was proposed candidate by his father the lord viscount STAFFORD, and immediately elected.

Sir JUSTINIAN ISHAM, knight and baronet, was also elected.

Mr. BOYLE prepared his book, intitled, *Several Traſſes: of the strange Subtily, great Efficacy, and determinate Nature of Effluvioms: of new Experiments to make the parts of Fire and Flame stable and ponderable: together with some additional Experiments about arresting and weighing of igneous Corpuscles; as also, a Discovery of the Perviousness of Glasse to ponderable parts of Flame: with some Reflections on it by way of Corollary:* printed at London in 1673, in 4to.

Mr. HOOKE shewed an experiment of water spreading itself, by a peculiar contrivance of a pipe, into a canopy (not a parabola, as is the ordinary way) and
revert-

reverting into the perpendicular, whence it came. Which figure he ascribed to the water's tenacity.

Sir WILLIAM PETTY was of opinion, that the first impetus of the falling water being too strong for the pressure of the ambient, spread itself abroad in that figure of a canopy; but that afterwards, the first impetus being abated, the ambient was able, by its pressure, to make the water return to its first perpendicular.

The lord viscount STAFFORD upon occasion mentioned, that he had kept mercury for six or seven years, in a bolt-head, upon the fire, in a sand furnace, with a paper only on the top of it, and that it still remained unaltered. He promised to give the Society a more particular account of this at their next meeting.

Dr. WALTER NEEDHAM mentioned somewhat like this done by himself; which he was desired to give a fuller account of.

Sir WILLIAM PETTY suggested on this occasion, that it would be worth while to make all sorts of experiments with mercury. To which he added, that as mercurial experiments should be one head for the Society's entertainment, so experiments of the magnet, of optics, and especially of motion, should make some of the other heads, that the Society should take in hand and pursue constantly.

Mr. OLDENBURG began to read Dr. SWAMMERDAM's answer to the letter written to him by three of the physicians of the Society, Dr. CROUNE, Dr. WALTER NEEDHAM, and Dr. KING, containing their report to the Society, about some anatomical controversy between Dr. SWAMMERDAM and Dr. de GRAAF: but there not being time enough to make an end of it at this meeting, the reading of it was referred to the next. The letter was as follows:

“ Illustriſſimæ Societati Regiæ

“ S. P. D.

“ GULIELMUS CROUNE,

“ GUALTERUS NEEDHAM,

“ EDMUNDUS KING.

“ Quandoquidem ab illuſtriſſima Societate Regia nobis tradita eſt illa de virorum clariſſimorum Drs. SWAMMERDAM & Drs. de GRAAF ſcriptis cognoscendi provincia; ea, qua decuit obedientia, munus, alias & invidiæ & difficultatis plenum, in nos ſuſcepimus.

“ Primo itaque in loco, utrique ab illuſtr. Societate gratias deferri exiſtimamus, quod (quum & ipſi per totam dudum Europam meritis ſuis inclaruerint,

* It is inſerted in the Letter-book, vol. vi. p. 241.

“ & etiam in Belgis sibi notos & familiares habeant viros, uti in omni genere doctrinæ, ita præsertim in anatome versatissimos,) nos in hac controversia appellare maluerint, quam iudices contreraneos, vel alios ubique celebres viros, quorum fama & in re-publica anatomica dignitas jus in hac lite dicendi auctoritatem sibi vindicare videbatur.

“ Id eo magis tantorum virorum candori tribuendum est, quod gliscente licet inter nos & Belgas bello atrocissimo, tamen tam philosophiæ felicitatem permittunt, ut inter literatos bonarumque artium cultores amicitia vetus, tam solidò fundamento innixa, neitiquam labefactetur. Controversia vero hæc libris agitata videtur ad duo potissima capita reduci posse. Quorum illud de inventorum auctore agit; hoc de descriptionum & sententiarum prolatarum veritate. De inventionis laude certantibus nescimus quid satis apposite a nobis responderi possit, quibus & res ipsa scitu ardua, & argumentum nimio nimis ingratum videbatur. Quem enim alium inventionis ordinem nos exhibere possumus, quam quem dudum typhothetæ exhibuerant? ut nempe post STENONEM GRAAFIUS, inde vero HORNIIUS, tandem KERKRINOIUS, rursum GRAAFIUS gemino tractatu, demum SWAMMERDAMIUS, & postremo RUISCH, vel de organis generationi inservientibus, vel de ovibus viviparorum, scripta sua evulgarent.

“ Quæ in libris illis tractentur argumenta, lectoribus obviam est: quibus vero artibus alter alterum prævenit, illud nobis minime innotescit; qui in viris prædictis omnibus arcana philosophica indagandi peritam admodum sedulitatem laudamus. Fieri interim potest, ut sine omni plagii crimine, qui forte posterior in inventum aliquod præclarum inciderit (de quo tamen hic nihil pronuntiamus) primus illud orbi literario exponat, & vel eo nomine diligentis suæ præmium ferat. Tales sane segnitici suæ poenas luent anatomici apud nostrates non pauci, qui multa tum in hoc ipso, tum in variis argumentis anatomicis apud se diu præserunt, donec in aliis similis inveniendi felicitas editione magis prompta & expedita nobilitata est.

“ Quod vero sententias ipsas utrinque prolatas attinet, illic, virorum clar. venia præfata, iudicium nostrum interponere audebimus.

“ 1. * Itaque arteriam spermaticam virilem recte descripsisse Dom. GRAAFIUM autoptæ asserimus, nec quæ sit illa a naturali fabrica recessio, cuius ipsum accusat Dr. SWAMMERDAM, hæcenus intelligimus. Descriptionem HORNIIANAM a tauro ad hominem infelicitè transferri, ex utriusque scriptis & ex re ipsa constat: interim non negamus, naturam in exiguis arteriis ita ludere, ut etiam ab his differre possint vasa Dom. SWAMMERDAM observata. Quid enim frequentius in anatomia occurrit, quam varietas illa, qua in minoribus abundare solet?

“ 2. * De tubulorum in testiculo, qui in epididymidem desinunt, deductione

* Mirac. Nat. p. 5. Part. genit. defens. pag. 22. * Mirac. Nat. p. 8. Part. genit. defens. p. 25.

“affirmanti GRAAFIO assentiri cogit modestiâ, idque eo magis, quoniam & a Dom.
 “VANDER WYEL id factum allegat, tum quia e nobis unus idem frequenter præ-
 “stiterit, qui tamen affirmat, vasa illa non semper eodem tenore & numero tes-
 “ticulo exire, ut epididymidi jungantur; neque in ejusdem generis subiectis duo
 “per omnia invicem consentientia a se inveniri; neque revera multum refert, an
 “duobus vel pluribus ductibus testiculo exeant hæc vasa, quæ in unum epidid-
 “ymidem certo certius coiunt.

“3. De medio, per quod semen a sanguine in testiculo separatur, difficile est
 “quicquam statuere. Non fieri illud per aliquam vasorum anastomasin, suadere
 “videtur rei ratio & vasorum in testiculo structura. Nempe arteria illuc immissa
 “eandem opera & tubulis seminalibus succum suum & venis sanguinem ministrat:
 “idque ita fieri credibile est, ut omnis arteriola capillaris, ut ut minutissima,
 “utrumque officium præstet. Raro hujusmodi secretionem perficit natura sine
 “alterius corporis interventu. An vero glandulæ, ut ut exigue, intersint, an
 “folia membranulis, quæ hic frequentes sunt, res perficiatur, aliis judicandum
 “relinquimus. Nemo nostrum glandulas ibidem conspicit. Determinationem
 “hujus quæstionis doctorum virorum ulteriori diligentia commendamus.

“4. De vesicularum seminalium cum deferentibus communicatione, & de
 “succorum seminalium numero, difficilior est controversia. Etenim in homine,
 “antequam vas deferens urethræ inseritur, dilatatio quædam est, sive cloaca com-
 “munis utrique parti, viz. sive epididymidi, sive vesiculæ exonerandæ idonea.
 “Si hujusce fabricæ probe contempleremur, videbimus, nihil in tota illius loci
 “structura impedire, quo minus vel hac vel illac profluat liquor, sive a dese-
 “rente in cavitates vesiculæ, sive etiam vice versa, quo minus junctis viribus suc-
 “cos utrumque organon per eandem sentinam simul & semel deiciat. Hujus rei
 “determinatio ex aliorum animalium analogia petenda videtur.

“Vesicularum harum cum vasis deferentibus schematismum, quatenus in ho-
 “mine se habent, satis fideliter expressit Dr. de GRAAF; a quo si in pauculis dis-
 “sentiat Dr. SWAMMERDAM, minoris illud nobis momenti videtur, & ad con-
 “suetos nature lusus referendum. Si quid ab accurata descriptione desit illud prope
 “exitum vasorum in urethram observamus, quo in loco vasa deferentia utrinque
 “in * * * vel vesiculam exiguum dilatantur, quæ caruncule in urethra appo-
 “sitis subjacet, adeo ut caruncula illa hujusce portio videatur.

“Hoc interim certum est tum de homine tum de equo (quod genus anima-
 “lium homini quoad vasa generationis proximum est in utroque sexu,) quod stylus
 “vasi deferenti immissus in urethram usque protendi facile potest. Si vero aut
 “statu aut liquore rem tentaveris, prius implebitur vesiculæ seminalis cavitas,
 “quæ quicquam in fistulam urinarium exiverit. Latius nempe est & patentius
 “illud diverticulum, nec ulla valvula donatum, cujus beneficio motus liquoris,
 “quoquo versum impulsus, sisteretur: cum interim vasis deferentis extremitas ca-

* Mirac. Nat. p. 9. Part. genit. defens. 25. * Mirac. Nat. p. 10. Part. genit. def. p. 26, 27.

“ runcula obturetur, quæ tum in viventibus extra coitum, tum in mortuis quæ
 “ que occlusa jacet, nec prius aperturam patitur quam impletis vicinis cellulis
 “ tota impellentis vis in illum solum dirigatur. Hinc fieri posse credibile est, quod
 “ in homine & equo si quid seminis extra coitum testiculo effluat, in cellulam hanc
 “ concedere potest; donec illa quoque impleta tandem eruptio consequitur, quæ,
 “ nisi cæstro venero fiat, plerumque noctu in lecto calentibus contingit, & pollutio
 “ nocturna appellatur. In coitus vero tempore per quamdam *συνπύρεξιν* partium una
 “ eademque opera utramque partem simul exonerari credimus, quam sententiam
 “ & GRAAFIUM privatis ad Dom. OLDENBURGIUM literis agnovisse intelligimus.
 “ Interim vero an vesiculæ illæ humanæ sint mera seminis ita delati conceptacula,
 “ an non & aliquid de suo addant, etiamnum quæri potest? Certe consimilis ei,
 “ quoad communionem cum deferentibus, vesicula equina in posteriore sua parte
 “ egregie glandulosa est; nec videtur vesiculæ humanæ folliculus a glandulosa na-
 “ tura abhorreere. Imo hanc partem vasii generis copiose instructam micro-
 “ scopium abunde detegit. Unde conjectare licet, iisdem separari humorem quen-
 “ dam usui generationis inservientem; idque eo magis, si alia animalium genera
 “ expendamus. Qui enim aprum, arietem, caprum, taurum, sub cultro habu-
 “ erit, videbit quam evidentissime, vas deferens nullam omnino cum vesiculis
 “ feminalibus rem habere. Instantiam ponimus in apro, ubi vesiculæ seminales
 “ maximæ sunt, & aliquot seminis libras in se continent. Quum harum succus
 “ cum semine testiculorum confertur, videbimus multis gradibus ab invicem dis-
 “ tate; ut ille testiculorum liquor ex albo flavescens florem lactis tum colore tum
 “ substantia commodè repræsentat. Si vero gustaveris saporem, exhibet insigniter
 “ dulcem cum astringente, qualem in saccharo Saturni agnoscimus. Interim vas
 “ deferens, licet per vesicularum seminalium medullarum transeat, tamen ne mi-
 “ nimo quidem porulo in easdem hiat, sed canalem suum in urethram rectè aperit.
 “ Vesicularum interim succus pellucidus est & coloris aluminosi ex crystallino sub-
 “ albicans. Sapiet fere cremorem tartari, pauco alumine adulteratum. Exit in
 “ urethram per foramina vesiculis propria: neque stylo, injectione, aut flatu quo-
 “ libet, harum cum deferentibus communio detegi potest. Quod ipsum de reli-
 “ quis animalibus modo recensitis verissimum.

“ Ex dictis conjectura deduci videtur, quod numerus succorum feminalium
 “ sequitur organorum ipsorum numerum. In piscibus nempe oviparis, & avibus,
 “ simplex est & unicus; in cane duplex, utpote cui desint vesiculæ seminales;
 “ pene dixeramus in tauro duplicem esse, utpote cui tantum non desunt prostates;
 “ exiguæ enim sunt & intra musculos, penis directores, adeo abscondite, ut
 “ anatomicum mediocriter peritum fallere possent. In arietibus, capris, et apris,
 “ manifesto triplex est. Idem de equo dicendum est, nisi insignes glandulas (e qui-
 “ bus constat posterior portio vesicularum feminalium) nihil excernere dicamus.
 “ Quidni & hominis eadem sit ratio? Nos tamen nihil hic audacter asserimus, ve-
 “ rum ulteriori disquisitioni remittimus. Interim notandum est, duplicem saltem
 “ succum etiam in homine concedere Cl. GRAAFIUM, viz. testiculorum & prosta-
 “ tarum, quem tamen posteriorem seminis appellatione non dignatur, sed vesiculum
 “ seminis vocat, quod gratis dici videtur: saltem controversiam ad logomachiam
 “ deducit. Interim optamus, ut periculum faciat vir doctissimus de excindendis ve-
 “ VOL. III. P sculis

" fœculis seminalibus^a; tum demum experiatur, an animalia hoc novo castrationis
 " genere multilata generationi æque fere idonea futura sint ac antea fuerunt. Nos
 " majora de natura in construendis organis solertia credimus^b. Digniss. SWAMMER-
 " DAM quadruplicem ponit materiam seminalem; quantum nempe succum e vase
 " deferente prope urethram glanduloso petit. Ille vero succus videtur ipsis ductus
 " hujus parietibus in illa confluentia liquorum (viz. testiculi & vesiculæ) unguendis
 " intervire, ut liquoribus liberior transitus permittatur. Si tamen obtineat iste
 " census, possumus nos in apro quintum assignare, non ex epididymide petitum,
 " (ut per jocum vult GRAAFIUS) verum ex glandulis peculiaribus majusculis,
 " medijs vesiculis seminalibus^c inuascensibus, urethræ vero seorsim implantatis.

" 6^a. Penis impletionem a sanguine infarcto pendere utrobique asseritur.
 " Quæstio est de rigiditate, quam GRAAFIUS potius animalibus spiritibus, corpo-
 " rum nervosorum tunicam distendentibus,tribuendam censet: idque ea ductus
 " ratione, quod penis injectionibus utcumque impletus tamen minus rigidus est,
 " quam in vivo animali apparere solet. Idem tamen (de viror organ. pag. 154.)
 " scribit se in cadaveribus, aqua, beneficio syringe, in corpora nervosa per arte-
 " rias propulsa, penem adeo extendisse, ut in vivis vix magis posset. Porro in
 " canis pene, quem coitus tempore retro vesiculum firmiter ligaverat, præter
 " sanguinem floridum se nihil reperisse affirmat. Si quid hic a vivi penis rigi-
 " ditate deficiat, nonne potius fibris in cadavere resolutis tribuendum est, quam
 " peculiari alicui spirituum animalium influxui deficienti? Fatemur quidem,
 " spirituum accessione fieri, ut in vivis vigorem & tonum obtineat fibræ illæ,
 " quæ in mortuis flaccescunt: sed hoc toti corpori cum pene commune est, neque
 " peculiarem hic loci spirituum affluxum poscit. Insuper probabile est, sangui-
 " nem, a cor'e in vivo animali per vasa naturaliter constituta in vivum & calen-
 " tem penem impulsam, poros ejusdem magis universaliter & adæquate implere,
 " quam id aqua in defuncto fieri potest. Idque eo magis credibile est, quia arte-
 " ria in mortuis inflata veram rigiditatem restituit^d.

" 7^a. At illa de emissionis seminis quæstio a neutro scriptorum solvi videtur.
 " Dicit quidem Cl. HORNIUS, ex urethræ structura facile intelligi, cur tam magna
 " adsit in pene tensio, & tam impetiosa seminis per eundem jaculatio. Utinam
 " illius ejaculationis rationem pluribus exhibuisset vir clarissimus, & in re sibi
 " adeo perspicua cæcitati nostræ gratificatus fuisset. Etenim semen cum impetu
 " proflire constat. Quorum vero musculorum ope vibretur, vel qua alia vi explo-
 " datur, non adeo clarum est. Testiculis quidem additos videmus cremasteres;
 " forte illi potius usui destinatos, quam meræ testium suspensioni, quæ æque
 " membrana peragi potuisset. Quid vero vesiculas seminales premit, quæ æque
 " cæstri venerici æquæ tam subitaneo motu exonerat? Quid glandulis proflatis
 " succum suum exprimit? Quid in omnibus hisce simultaneam eam *εμπροσθεν*
 " excitat? Prostatas quidam apruinas musculus validis donari agnoscimus.
 " Neque enim aliter exprimi potuit tam viscidus liquor, qui in illo animali
 " quovis glutine tenacior est. Verum vesiculæ seminales illic aliquot libras

^a Part. Genit. defens. p. 31.

^b Mirac. Nat. 5. p. 11.

^c Mirac. Nat. p. 13.

^d Part. Genit. defens. p. 32.

^e Mirac. Nat. p. 12.

^f Part. Genit. defens. p. 6.

“ continent humoris, non in unica aliqua cavitate fluctuantes, sed in vesiculis innumeris, ad methodum fere pulmonum MALPIGHIANORUM reconditi. Nullo interim musculo comprimuntur, neque quo pacto se emulgeri finant, facile comperimus. Quod ipsum de plerisque saltem animalibus verum est. Solas talpas excipit doctiss. SWAMMERDAM, quorum et vesiculis seminalibus & epididymidibus musculos appendi asserit. Interim suam de ejaculatione feminis sententiam addit¹, in qua primo affirmat, feminis motum a toto sanguine pendere, & non nisi tempore coitus excerni. At contrarium evincit aprugna dissectio, ubi nunquam non multas uncias feminis invenies, licet in toto anno precedente non coiverit, nec sui appropinquaverit. Secundo², universalem eo tempore muscutorum corporis omnium contentionem, præcipue vero eorum, qui ad partes seminales pertinent, assignat tanquam excretionis causam. At vero, quomodo motus ille comprimit vesicularum seminalium manticam a muscutorum horum tergo pendentem, & plerunque, si non semper, semine gravidam, doctiss. GRAAFIUS, descripta prius erectionis & compressionis urethra: ratione pergit dicere: *urethrae compressione (viz. muscutorum ope) e vesiculis seminariis & vasibus deferentibus in urethram propulsum semen, ibique menstruo suo* (sc. e prostata affluo; *permixtum ulterius propelli pesse.* Non libet integram hanc controversiam evolvere; unicum tantum rogamus, nempe, concessio, quod semen, postquam fistulam urinariam intraverit, a musculis penis vibratur & vi emittitur; quid demum est, quod semen illuc asserit? Etenim tum testiculi, tum vesiculae seminales, tum etiam glandulae prostatae extra eorum muscutorum, ut & ipsius urethrae, potestatem collocantur.

“ 8. Complura in schemate SWAMMERDAMIANO, quod cl. Dom. TULPIO dicavit, culpata GRAAFIUS, forte non immerito: quæ tamen omnia ab autore ipso in subsequenibus figuris postea editis emendantur.

“ 9. De internis vero clitoridis cruribus (quæ Dr. SWAMMERDAM nonnunquam occurrere ait) asserit e nobis unus³, se carnearum fibrillarum cylindrillos quosdam reperisse, musculis proxime adjacentibus distinctos, iis forte similes, quos notavit author modo laudatus.

“ 10. Porro notat idem, ligamenta uteri teretia non vasa modo sed & fibras musculosas obtinere, & motibus quasi muscularibus inservire poss. Reliquæ inter hos duos viros agitatae controversiæ minoris momenti esse videntur quam ut censuram mereantur. Londini, d. 15 Augusti, 1673.”

The lord bishop of Salisbury reported the sense of the council held this day to the Society, concerning their return to Gresham College, and represented what great obligations the Society had to the earl marshal, for having received them so generously at first, and entertained them so nobly for so many years in his house, acquainting them withal, that the council had already expressed their deep sense of such great favours to his lordship.

Whereupon the Society, concurring with the council about the returning to

² Mirac. Nat. p. 14.

³ Ibid.

¹ Dr. KIRK.

Gresham College, resolved that they would presently in a body attend the earl marshal likewise, and join their humble acknowledgments with those of the council for his lordship's extraordinary favours and kindnesses to them, desiring the lord bishop of Salisbury, who was then in the chair, to be their mouth in this address: and this was done accordingly.

November 13. At a meeting of the COUNCIL were present

The lord bishop of Salisbury in the chair ;

The earl marshal,
Sir JOHN LOWTHER,
Sir PAUL NEILE,

Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

It was ordered, that the following persons, or three of them, of whom the president and Mr. OLDENBURG were to be two, be a committee for auditing the accounts of the treasurer ; and that they meet for that purpose on the Monday following, the 17th instant, about three of the clock in the afternoon, at the president's house ; these persons being the president, Sir JOHN LOWTHER, Dr. GODDARD, Mr. HILL, and Mr. OLDENBURG.

It was ordered also, that the following bond be shewn by the amanuensis to Mr. LE HUNT ; and upon his alteration, if he see cause for any, some copies be forthwith made and presented, or sent about by the treasurer, to be signed by those, who do not presently pay their arrears in ready money : and that such of the nobility, as should make use of this bond, yet so as to order their stewards to sign in their stead, should be complied with in this particular.

The bond was as follows :

*" Noverint universi per presentes me teneri & firmiter obligari
" præsidi, concilio, & sodalibus Regalis Societatis Londini pro scientia naturali pro-
" movenda & successoribus in libris bonæ & legalis monete Angliæ solvend.
" eidem præsidi, concilio, & sodalibus, aut successoribus suis, aut eorum certo attor-
" nato : ad quam quidem solutionem bene & fideliter faciend. obligo me, heredes, exe-
" cutores, & administratores meos firmiter per presentes, sigillo meo, sigillat. Dat.
" anno regni Domini nostri Caroli II. Dei gratia Angliæ, Scotiæ, Franciæ,
" & Hiberniæ Regis, Fidei Defensoris, &c. vicesimo tertio, annoque Domini, 1673.*

" The condition of this obligation is such, that if the above bounden
" his heirs, executors, administrators, or assigns do well and truly pay,
" or cause to be paid, unto the above named president, council, and fellows of
" the Royal Society, or their successors, or assignee or assignees, the full sum of
" of lawful money of England, it being his arrears due to the
" president, council, and fellows of the Royal Society aforesaid, according to his
" engagement upon his admission into the said Society, on the day
" of next ensuing the date hereof, to the use of the said president,
" council,

" council, and fellows, and their successors; then this obligation to be void, or
 " else to remain in full force and virtue.

" Sealed and delivered,
 " in presence of

It was resolved, that for want of time, the execution of that part of the order made at the late council of November 6th, which relates to the legal tie to be subscribed for securing the weekly contributions for the future, be deferred till after St. Andrew's day.

At a meeting of the Society on the same day,

Dr. WALLIS paid to the treasurer forty shillings for Mr. BERNARD's admission-money, having received orders so to do from Mr. BERNARD, whose occasions would not yet permit him to appear in person at the Society.

Mr. OLDENBURG presented to the Society, from Mr. BOYLE, his new book, intituled, *Treatise, consisting of Observations about the Saltiness of the Sea: an account of a Statical Hygroscope, and its Uses; together with an Appendix about the Force of the Air's Moisture: and a Fragment about the natural and preternatural state of Bodies: by the honourable R. BOYLE: to all which is premised a Sceptical Dialogue about the positive or privative nature of Cold, by a member of the Royal Society: printed at London, 1673, in 8vo.*

Mr. HOOKE was called upon for his account of the experiment made November 6. of water spreading itself into a canopy, and reverting to the perpendicular. He excusing himself, that he had not been able to make it ready, was desired to prepare it for the next meeting.

He shewed an experiment concerning the springiness of glass, by applying to a slender glass-pipe a wax-light on all the sides thereof, by which it appeared, that the light being held on the top of the pipe, the farther end of the pipe sunk; held underneath, it rose; held on the side towards the hand applying, it turned from him; held on the opposite side, it turned towards him.

The cause of this phenomenon was by some conceived to be the expansion of the glass on that side, where the light is applied.

Sir WILLIAM PETY said, that it was a desirable thing to have a good theory of the springiness in bodies.

Mr. HOOKE mentioned, that formerly he had explained it, in a discourse of his, brought in upon the occasion of the odd phenomenon of the pipe of mercury standing top-full far above the ordinary station.

He was desired, since that discourse was not yet brought in by him, that he would bring it in; which he promised to do.

Hg

He promised also to bring in some experiment or other at the next meeting.

Mr. OLDENBURG read a paper of Mr. LISTER, containing an account of some of the parts of certain stones figured like plants, together with thirty-seven figures, curiously drawn to represent the same¹.

November 20. A committee was chosen by ballot, for auditing the treasurer's accounts, consisting of Sir WILLIAM PETTY, Sir THEODORE de VAUX, Mr. CREED, Mr. HOOKE, and Mr. VERNON, three of whom were to be a quorum, and to meet on the Thursday following, November 27. about two in the afternoon, at Arundel House.

The lord bishop of Salisbury acquainted the Society, that those eminent citizens of London, who had been formerly deputed by the city and the Mercer's company, to invite the Royal Society to return to Gresham College, viz. Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, and Mr. ROWLAND WYNNE, had upon occasion expressed, that they should esteem it as an honour to be elected into the Royal Society: whereupon his lordship now proposed them all four as candidates, and desired the Society to meet the next week, in such a number as was requisite to make an election.

Mr. ANDREW BIRCH was proposed candidate by Sir THEODORE de VAUX.

Mr. HOOKE shewed a microscope, with one only globule of glass, fastened to an instrument with many joints, to turn every way, and so to shew the object on every side with greater distinctness than other microscopes: which kind of microscope, he said, a German had brought over with him out of Holland, but that it had been long since hinted by himself in the preface to his *Micrographia*.

He was put in mind both of his account of the experiment made November 6, with water, and of his discourse concerning elasticity.

Mr. OLDENBURG presented from Mr. HEVELIUS his book, intitled, *Machine Cælestis pars prior, Organographiam Astronomicam exhibens, &c.*

November 27. At a meeting of the COUNCIL of the Society were present,

The lord bishop of Salisbury in the chair,	
The earl marshal,	Sir PAUL NEILE,
Mr. CHARLES HOWARD,	Mr. COLWALL,
Sir JOHN LOWTHER,	Mr. HILL,
Mr. AERSKINE,	Mr. OLDENBURG.

The receipt for the four hundred pounds, bequeathed by the late Dr. WILKINS, bishop of Chester, deceased, to the Society, was signed and sealed in coun-

¹ Letter-book, vol. vi. p. 371 and 339. It is printed in the Philof. Transact. vol. viii. n^o 100. p. 6181. for January and February, 1672.

cil, and ordered to be delivered to Dr. TILLOTSON, dean of Canterbury; and Mr. COLWALL, the treasurer, was desired to keep the money in his custody till farther order.

The committee of the council for auditing the treasurer's accounts made their report ^a.

At a meeting of the SOCIETY on the same day,

Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, Mr. ROWLAND WYNNE, and Mr. ANDREW BIRCH were elected into the Society.

Mr. ELSERS, a foreigner, shewed the Society a small agate, of the size of a pea, having on the one side the perfect effigies of a face, resembling naturally, as he affirmed, pope ALEXANDER VII. being compared with a medal of that pope, which Mr. ELSERS had procured at Rome purposely for comparing the agate with it on this occasion. On the other side appeared the face of the present emperor ^b, if held one way, and another face, if held another way; besides several other faces, which the owner of the agate imagined to be there, but which could not well be discerned by any of the Society.

He shewed likewise several patterns of stuff, which by the preſs had received the likeness of cloth of gold and silver; for the making of which manufacture in England, he said, a certain German, then in Holland, intended to procure a patent.

The lord viscount STAFFORD brought in an account in writing, of what he had related 6th November, concerning the unaltered quicksilver, notwithstanding it had been on the fire for the space of fifteen years: to which was added an account of the increase of weight in brimstone by fire. It was ordered to be entered in the Register-book ^c.

Mr. HOOKE shewed an attempt of his, of making a vessel so thin, that when evacuated of the air contained in it, it might swim in the air. He mentioned also, that a certain Italian clergyman, named LANA, had written upon this subject; whose book he thought had been formerly presented to the Society by their secretary, but was still in his hands.

December 1. St. Andrew's day, November 30. having this year fallen upon Sunday, the Society, by virtue of their charter, kept their anniversary election upon this day; at which, were present five and fifty members.

Sir JOHN LAURENCE, Sir RICHARD FORD, Sir THOMAS PLAYER, Mr. ROWLAND WYNNE, and Mr. ANDREW BIRCH were admitted.

^a This report was forgot to be entered in the Council-book, vol. i. p. 225.

^b LEOPOLD.

^c It is not entered there.

The committee of the Society for auditing the treasurer's accounts made their report, as follows :

" At a committee of the Royal Society for auditing the treasurer's accounts,
" November 27, 1673,

" We find Mr. DANIEL COLWALL debtor,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
" To monies he hath received on the quarterly payments of the So-			
" ciety from 23d November, 1672, to 13th ditto, 1673 - - }	142	19	6
" To money he hath received for admission - - -		2	0
" To the balance of his last account - - -		7	9
	<u>£</u>	<u>152</u>	<u>8</u>
		8	9

" We also find he is creditor,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
" By monies he hath paid to the use of the Society - - -		146	16
" Balance resting in cash in his hand - - -		5	12
	<u>£</u>	<u>152</u>	<u>8</u>
		8	9

" Signed,

" WILLIAM PETY,
" THEODORE de VAUX,

" FRANCIS VERNON,
" ROBERT HOOKE."

This done, the Society proceeded to the work of this day; and by their election there were continued of the council these eleven, viz.

The lord viscount BOUNCKER,
The lord BERKLEY,
Mr. COLWALL,
Dr. GODDARD,
Mr. HILL,
Mr. HOSKYNs,

Sir JOHN LOWTHER *,
The earl of Norwich, earl marshal
of England,
Sir PAUL NEILE,
Mr. OLDENBURG,
The lord bishop of Salisbury.

The new chosen members of the council were these ten, viz.

Mr. BOYLE,
Mr. BARRINGTON,
Mr. CREED,
Sir JOHN CUTLER,
Dr. WALTER NEEDHAM,

Sir WILLIAM PETY,
The earl of SHAFTESBURY,
Sir ROBERT SOUTHWELL,
Sir CHRISTOPHER WREN,
Mr. WYLDE.

Out of these were elected officers,

* This name is omitted in the Journal, vol. v. p. 48. but restored from the printed list of the Society for 1674.

The lord viscount Brouncker, president,
 Mr. Colwall, treasurer,
 Mr. Hill,
 Mr. Oldenburo, } secretaries.

Of the new members of the council were sworn Sir William Petty and Sir Robert Southwell.

Before this annual election the Society had an important loss by the death of

Sir Robert Moray, who was descended of an antient and noble family in the Highlands of Scotland, and educated partly in the university of St. Andrews, and partly in France, where he had afterwards a military employment in the service of Lewis XIII.¹ and gained so high a degree of favour with cardinal Richelieu, that few strangers were ever so much considered by that great minister as he was². He was raised to the rank of colonel in France, and came over to England³ for recruits, when king Charles I. was in with the Scots army at Newcastle, where he grew into great esteem with his majesty, for whose escape, about December, 1646, he laid a design in the following manner⁴: Mr. William Moray, afterwards earl of Dyfart, had provided a vessel by Timmouth, and Sir Robert Moray was to have conducted the king thither in a disguise; and it proceeded so far, that his majesty put himself in the disguise, and went down the back stairs with Sir Robert: but apprehending, that it was scarce possible to pass all the guards without being discovered, and judging it highly indecent to be taken in such a condition, he changed his resolution, and went back.

Upon the restoration of king Charles II. he was made one of the privy council to his majesty in that kingdom. He was one of the first and most active members of the Royal Society, and as early as December 5, 1660, brought a message from the king, that his majesty had been acquainted with the design of their meeting, and well approved of it, and would be ready to give an encouragement to it⁵. March 6, 1663, he was chosen president of the Society⁶, as he was again for another month on the 10th of April, 1661⁷; and several times after⁸. In the first charter granted to the Society, of July 15, 1662, and the second, of April 22, 1663, he was nominated one of the council to it. He died suddenly in his pavilion in the garden at Whitehall, July 4, 1673, and was interred at the king's charge in Westminster-abbey near the monument of Sir William Davenant⁹. Mr. Wood affirms¹⁰, that he was a *single man*, and an *abborrer of women*; but this is a gross mistake, for Sir Robert married the sister of the lord Belcarres¹¹. He was universally beloved and esteemed; and eminent for

¹ Wood, Athen. Oxon. vol. ii. col. 370.

² Burnet, History of his own Time, volume i.

³ Mr. Wood, *ibid.* supra, says, that he had been general of the ordinance in Scotland against king Charles I. when the presbyterians of that kingdom first set up their covenant.

⁴ Burnet's Memoirs of the Dukes of Hamilton, l. 5. p. 307.

⁵ See above, vol. i. p. 4.

⁶ *Ibid.* p. 17.

⁷ *Ibid.* p. 85, 87.

⁸ Wood, *ibid.* supra.

⁹ Burnet, *ibid.* of his own Time.

¹⁰ *Ibid.* p. 21.

¹¹ *Ibid.*

his piety, spending many hours a day in devotion in the midst of armies and courts. He had an equality of temper in him, that nothing could alter, and was in practice a stoic, with a tincture of one of the principles of that sect, the persuasion of absolute decrees. He had a most diffused love to mankind, and delighted in every occasion of doing good, which he managed with great zeal and discretion. His comprehension was superior to that of most men. He was considerably skilled in mathematics, and remarkably so in the history of nature; and his genius resembled that of the illustrious PEIRESKIUS, as described by GASSENDUS⁷.

December 4. FRANCIS ROBARTES, Esq; son of JOHN lord ROBARTES, and Col. GILES STRANGWAYS, were proposed candidates by the lord bishop of Salisbury; as was likewise JOHN le GASSICK, M. D. by Sir WILLIAM PETTY.

The earl of Salisbury, Mr. BOYLE, Mr. BARRINGTON, and Mr. CREED, were sworn members of the council.

There was present at this meeting the abbé D'ANGEAU, brother to the marquis of that name, who had attended her royal highness the dutchess of York from Paris to London.

Mr. HOOKE shewed an experiment of the springiness of coal; which was, that one side of a piece of charred wood or coal being heated, that side did (as in the like experiment formerly made with glass) bend from the heat, as appeared by a long stick fastened thereto, and the end pointing to a fixed mark.

It was also tried again with a glass pipe, as likewise with a brass wire; which latter stirred but very little, and almost insensibly.

There was produced a microscope of Mr. SMETHWICKE's contrivance, said by him, as Mr. HOOKE reported, to have glasses not spherical, but of a conic section: which figure the author, as was said, affirmed he could make and polish with certainty. Being tried, some of the members found it shew the object very distinctly without any colours, and magnify it very considerably.

It was thought necessary to compare it with some very good ones of a spherical figure.

December 11. FRANCIS ROBARTES, Esq; Col. STRANGWAYS, and Dr. le GASSICK were elected.

Mr. HOOKE brought in an apparatus to shew by experiments the strength of the loadstone's attraction, and to find in what proportion it draws, at several distances.

He was ordered to fit this apparatus so, that the design of it might be well prosecuted.

⁷ Idem, ibid.

Upon this occasion Sir WILLIAM PETTY moved, that the Society would give orders, that there might be a constant apparatus of instruments ready for the making of several kinds of experiments depending on several heads; for instance, for experiments of motion, optical, magnetical, electrical, mercurial, &c. And that such instruments, as had been formerly used by the Society, and were out of order, might be repaired, and all these put together in a room by themselves, to be ready upon occasion for strangers, or for repetition and farther prosecution of the several sorts of experiments.

Dr. GREW was desired to produce some botanical observations at the next meeting; which he promised to do.

Mr. OLDENBURG read a letter in Latin, written at Rostoch, 11th March, 1669*, addressed to the president and fellows of the Society, by Dr. SEBASTIAN WIRDIG, professor of physic at Rostoch, desiring the Society to give their judgment of his book dedicated to them, and intitled *Sebastiani Wirdig, M. D. Nova Medicina Spirituum, &c.*

It was thought strange, that the letter bore so old a date, and that there was such a distance between that and the publication of the book; which was delivered to Sir WILLIAM PETTY, that he might peruse it, and make a report of it to the Society.

Two letters of Signor CASSINI, dated 22d September, and 8th November, 1673, were read, containing some observations of his about the two lately discovered satellites of Saturn, and others concerning the diameter of the circumjovialists; together with an account of the charges and apertures of his glasses of thirty-five and twenty-one feet.

A letter of the lord HERBERT*, returning thanks to the Society for his election, was read.

A letter of Monf. JUSTEL to Mr. OLDENBURG, from Paris, 26th September, 1673*, was likewise read; containing a description of the icy mountain, called Gletcher, in the canton of Berne in Helvetia.

Mr. BOYLE shewed the Society a little floating instrument of his, (called by him a *floating leadstone*) which discovers, whether guineas, for example, be counterfeit or not, by putting the instrument with the piece of coin to be tried and fastened to the bottom of it, into a tall glass or other vessel of water; certain marks being so made on the slender metalline pipe, which makes the upper part of the instrument, that the hollow ball, which makes the lower part of it, will sink much lower, (at least two inches) if the coin be true gold, than if it be not; and

* This is the date in the Journal, vol. v. p. 52. but in the Letter-book, vol. vi. p. 328, 329, the date is 1st March.

* Letter-book, vol. vi. p. 249.

* Ibid. p. 310. It is printed in the Philosoph. Transact. vol. viii. n^o 100. p. 6191. for January and February, 1674.

according as the water reaches to one or other of the aforesaid marks, an estimate may be made, whether the piece of coin, if counterfeit, be made of tin, brass, copper, silver, or lead. The same instrument may be applied to other gold coins; as also to silver coins, if they be of any considerable bulk.

The experiment was made several times by Mr. BOYLE's direction.

December 18. Mr. HOOKE produced again his instrument for determining the force of the loadstone's attraction at certain distances: but the apparatus still failing, he was desired to fit it better for the next meeting.

Dr. GREW shewed two figures of two microscopical observations, which he had made; one of the trunk of an ash tree, the other of that of a berberis, explaining both wherein their structure agreed, and wherein they differed. He promised to produce more observations of this kind at the next meeting.

Mr. OLDENBURG presented to the Society from Dr. THOMAS WILLIS his new book, intitled, *Pharmacœuticæ rationalis, sive Diatribæ de Medicamentorum Operationibus in humanæ Corpore*: printed at Oxford, 1673, in 4to.

Dr. KING having already perused this book, gave some account of it to the Society, and mentioned particularly the author's description of an artery and of its muscular motion like that of the heart, promising, that he would bring in the scheme of an artery not added to Dr. WILLIS's book.

Mr. OLDENBURG delivered to the Society in the name of Signor PAUL BOCCONE, a Sicilian botanist, his collection of curiosities in three boxes, which, before his leaving England, he had desired to be presented to them for their repository; containing the following particulars^a, transcribed out of a French paper left by the presenter with Mr. OLDENBURG, viz.

“Memoire du cabinet, que Monf. BOCCONE à présenté a la Société Royale l'an. 1673.

“1. Le fruit de la mûse, ou mauze de Prosper Alpinus.

“2. *Papyrus Ægyptia penæ, sive papyrus nilotica Gerardi.*

“3. *Fucus typhoides Melitenfis coccineus.*

“4. *Fucus sive alga spiralis maritima.*

“Toutes plantes rares et estrangeres; et plus

“5. Pièces qui monstrent l'alteration et la petrification des herissons de mer;

^a An account of part of them is printed in the Philosoph. Transact. vol. viii. n° 99. p. 6158.

“ ſçavoir *Echinus ovariis ſive eſculentus* dans le naturel, et petrifié: *Echinus ſpagus* ou *Briffio* d’ Imperatus et de Rondelet, dans le naturel ; par ou l’on peut examiner leur changemens : avec d’ autres pieces et morceaux d’ heriffons de mer, appellé de l’ Imperatus *ifrice marino*.

“ 6. Pieces, qui monſtrent la reſemblance, qu’il y a entre les dents du poiſſon carcharias, chien de mer, et ſemblables, avec les gloſſopetres, par ou l’on conjecture le changement des dites dents en pierre.

“ 7. Pieces, qui monſtrent les parties, qui compoſent l’ aſtroites ou la pierre eſtoillée par le moié de quelques turſaux coralloides, per celui de la millipore d’ Imperatus ; et par la ſtructure de la meme pierre, qui n’eſt autre choſe, qu’un aſſemblage de *topus* ou d’ argille endurcie enſuite comme des pierres.

“ 8. Pieces et parties, qui compoſent la corne d’ Ammon, laquelle eſt remplie de petites boules. Il faut prendre garde, que la corne d’ Ammon d’ Imperatus, appellé par d’ autres *ebur ſoſſile*, eſt tout autre choſe.

“ 9. Pieces, qui monſtent, que la plus ſouvent les pierres, qui ont la figure de coquille, ne ſont autre choſe que de l’ argille renfermé entre deux couvercles.

“ 10. Pierres appellées *conchæ lapideæ gibbæ*, leſquelles, quoi qu’ elles ayent la figure de coquille, ſont neantmoins produites *per juxtapoſitionem* comme d’ autres pierres ou des calloux : obſervation tres neceſſaire pour diſtinguer les precedentes pierres, qui ſont moulées par la compreſſion des veritables coquilles.

“ 11. Pieces et parties du deſgorgement de Mont *Ætna* reduites en une matiere ferrugineuſée ſemblable au machefer, qu’on tire des fourneaux des forgerons : ſel armoniac blanc : ſel armoniac taché de ſaffron, et ſel armoniac taché d’une couleur de vert gris ; leſquels on à tiré ſur la matiere embrasée apres que le feu à eſté eſtiñct.

“ 12. Figure de poiſſon, appellé cicerello à Meſſina.

“ 13. *Sanguisuga pinnata*, qui ſuce le ſang du poiſſon *XIPHIA*, peſce *spada*, avec le poux et le capreoli, dans le naturel.

“ 14. Pieces, qui monſtrent l’ obſervation de corail rouge et blanc étre veritable, que le dit Boccone tient eſtre produit *juxtapoſitionem*, apres avoir eſloigné le corail de l’eſpece des plants, et dit, que le corail n’a point de ſemence. Il fait voir ſon principe ou ſa premiere impreſſion ſur un morceau de bois environné de corail vray et ſolide et d’ autre tendre comme du tartel corailin par ou il à conjecturé que les degres du corail veritable de Dioscoride ne ſont qu’une viſcoſité corailine, qui ſouvre et pouſſe des pores eſtoillées une eſpece de tartre, qui eſt couvert de la dite viſcoſité ou *fucus* rouge, et le corail parfait ſolide, et par ou on croit pouvoir faire voir, que la nature du corail s’approche a celle des pierres.

“ 15.

" 15. *Pieces et morceaux de corallium abum punctatum stellatum*, pour faire examiner combien ces especes de corail sont estoignées des plants.

" 16. *Lapis fissilis bitumen redolens, in mentibus Hybleis in Sicilia repertus.*

" 17. Pierre bezoar mineral Sicilien."

December 22. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
The lord bishop of Salisbury,	Dr. Walter Needham,
Sir John Lowther,	Mr. Colwall,
Sir Paule Neile,	Mr. Hill,
Sir William Petty,	Mr. Oldenburg.

The council taking again into serious consideration the necessity of collecting the arrears due to the Royal Society resolved, that the following order should be delivered to such members of the Society, as were in arrears, viz.

" In pursuance of a former order of the council made the 6th of November, 1673, it was this day ordered, that the earl of Dorset, the earl of Aylebury, the lord viscount Stafford, Sir John Lowther, Sir William Petty, Sir Peter Wyche, Sir Cyril Wyche, Sir Theodore de Vaux, Sir Christopher Wren, the treasurer and the secretaries of the Royal Society, and Mr. Hooke, or any four or more of them, be desired to apply themselves to such members of the said Society, as are in arrears, and to acquaint them, that this council being now upon making a new regulation for a firm establishment of the said Society; in order whereunto the arrears due to the same are to be forthwith collected; every fellow being thus in arrear is desired forthwith to pay to the treasurer, Mr. Colwall, or his deputy, so much thereof, as was due at Michaelmas last, or at least to give a sufficient bond for the doing thereof within the space of six months from the date of the aforesaid order.

" It was likewise then declared, that such of the fellows, as shall neither make present payment of their respective arrears, nor give bond as aforesaid, shall be accounted to have deserted the said Society, and be provided against according to the statutes; and that the Society will proceed to a legal recovery of the said arrears."

This order was signed by

The president,	Sir William Petty,
Seth, lord bishop of Salisbury,	Mr. Colwall,
Sir John Lowther,	Mr. Hill,
Sir Paul Neile,	Mr. Oldenburg.

Dr. Needham went away before signing.

It

It was ordered likewise, that copies be made of the statute for election, and of that for payment; as also of the obligation subscribed by every fellow at his admission; and that the committee named in the former order be furnished with such copies, to be shewn upon occasion to those, whom they shall make application to:

That the said committee be desired to apply themselves by letters to those, who were in the country, and others, whom they could not have an easy access to.

It was resolved, that if any fellow should be ejected on this occasion, the cause of the ejection be recorded.

It was ordered, that Mr. BOYLE, Sir WILLIAM PETTY, Sir CHRISTOPHER WREN, Dr. GODDARD, Dr. GREW, and Mr. HOOKE, be desired to draw up a list of considerable experiments to be tried before the Society, and to prepare an apparatus necessary for the exhibition of them upon all occasions.

Sir WILLIAM PETTY was desired to take a particular care of seeing the import of this order put into effect.

There being some members of the Society, the time of whose admission did not appear upon the journal, as the earl of Anglesey, Sir JOHN BIRKENHEAD, Sir ROBERT HARLEY, and Mr. THOMAS HARLEY, it was ordered, that the printed yearly lists of the Society should be perused, to see what year those members were printed the first time, and from thence a measure taken of stating their accounts.

After this it was thought convenient, that as many of this council, as conveniently could, should meet in some other place, to avoid disturbing the earl marshal too long, and there make a distinction in several columns of the fellows of the Society, according as they constantly pay or not pay, and of such, as are honorary, absent, excused, or doubtful.

This was done accordingly by Sir JOHN LOWTHER, Sir WILLIAM PETTY, Mr. COLWALL, Mr. HILL, Mr. HOOKE, and Mr. OLDENBURG, who having found fifty-three fellows, who paid well, and seventy-nine, who did not, and fourteen absent in the country, resolved to apply themselves with all possible speed to the seventy-nine; and, in order to it, desired, that the copies of the above-mentioned statutes might be speedily made, and the said list of the seventy-nine fairly written out, together with the arrears due by every one of those; as also that a letter might be drawn up by Mr. OLDENBURG, to be sent by the committee to the absent with all possible safety, acquainting them with the council's order of collecting the arrears, and desiring those, who were concerned, to give in their positive answer by the next post to the said secretary.

December 25. being Christmas-day, the Society did not meet.

167 $\frac{1}{2}$. January

1672. *January 1.* The Society did not meet, it being New-year's-day.

January 5. At a meeting of the council were present

The lord bishop of Salisbury, vice-president, in the chair,	
Sir JOHN LOWTHER,	Mr. CREED,
Sir WILLIAM PETTY,	Mr. COLWALL,
Sir ROBERT SOUTHWELL,	Mr. HILL.

It was discoursed, whether if any person pay fifty pounds, he shall be accounted a benefactor, according to the statute, though part of the said sum be already due from him for arrears?

It was ordered, that the treasurer pay into the Mercers company of London four hundred pounds now in the chest of the Society, taking their bond for repayment, with such interest as he could get for the same, not less than five per cent. and that the bond so taken be deposited in the said chest:

That the clerk give lists of the persons in arrears to the several members of the committee for demanding the arrears: And,

That the treasurer give deputations to each of the said committee to receive any sum in arrear, and to give a sufficient discharge for the same.

January 8. The Society did not sit, there being but very few members present:

January 15. Mr. HOOKE made an experiment with a ruler divided into such parts, as being placed at a certain distance from the eye, appeared to subtend a minute of a degree; and being earnestly and curiously viewed by all the persons present, it appeared, that not any one present, being placed at the assigned distance, was able to distinguish those parts, which appeared of the bigness of a minute, but that they appeared confused. This experiment he produced, in order to shew, that we cannot by the naked eye make any astronomical or other observation to a greater exactness than that of a minute, by reason, that whatever object appears under a less angle, is not distinguishable by the naked eye; and therefore he alleged, that whatever curiosity was used to make the divisions of an instrument more nice, was of no use, unless the eye were assisted by other helps from optic glasses.

Mr. OLDENBURG produced a box containing some mineral concretes, together with a description of them, presented to the Society by Dr. LUCAS HOBSON of Newcastle upon Tyne, as himself had collected them from the tops and sides of the subterranean chimnies, as he called them, of a coal-mine betwixt Benwell and Fenham, near the said town of Newcastle, which had burnt continually for forty years past. The particulars contained in distinct papers, were as follow:

A. Sulphur, with some flowers.

B. Sal

B. Sal armoniac of various forms and figures, some of it yellow, by reason of the sulphur.

C. The white mafs (mentioned in the large description) after it had lain in the air.

D. The white mafs newly brought from the fire.

E. Sal armoniac in soft flowers.

F. A piece of the marcasite, or lapis pyrites.

G. Sal armoniac in splendid crystals of various figures.

H. Sal armoniac sublimed, after it was taken from the fire.

I. Sal armoniac sublimed, amongst burnt whins and furzes.

K. A bottle of the spirit of this sal armoniac, as it was taken from the fire.

L. The salt of a Spaw near Newcastle.

It was ordered, that the hearty thanks of the Society be given by a letter of the secretary to Dr. HODGSON, for these curiosities; and that he be desired to continue such communications, as he should find occasion.

It being moved, that Dr. DANIEL COX having made many observations and experiments concerning the nature and figures of all sorts of salts, might be desired to impart them to the Society, he was desired accordingly, and promised, that he would do so, after he had viewed and examined such salts by such a microscope, as had been approved of for its goodness by the Society: and a microscope being brought by Mr. COCK to be examined, the trial of it was referred to a fitter time, it being then candle-light.

January 22. Mr. HOOKE proposed the making of a new kind of astronomical instrument of his own invention for the taking of heights, angles, and distances, of celestial bodies by one observation more exactly than ever was yet done, viz. to a second. He added, that in this way the exactness of the instrument, as to divisions, sights, and perpendicularity, might, upon occasion, be duly ordered by the astronomical observer, so as not to rely upon the credit or skill of the instrument maker.

He being asked, what the making of such a quadrant would amount to, and answering, that he thought it could be made for less than ten pounds, it was ordered, that he should cause one to be made of that price.

The experiment made at the last meeting, to shew, that with common sights we are not capable to distinguish a minute, was repeated; and proved what it was designed for.

Mr. OLDENBURG read a letter to him from Mr. LISTER, dated 7th January, 1673^b, concerning an old *fungus subterraneus*, of a bituminous nature, found in a rocky lime stone ground in Derbyshire; as also an uncommon mineral liquor, white, resembling cream, found at the bottom of a coal-pit, and in iron-mines, in great quantity.

It was ordered, that Mr. LISTER should be desired to send a specimen of each of these curiosities, if he could spare any of them.

Mr. LISTER having formerly sent some of his blood-stanching liquor, with a desire, that trials might be made with it before the Society, it was ordered, that the operator should provide a dog against the next meeting for that purpose.

January 29. The Society did not meet.

February 5. FRANCIS ROBERTES, Esq; was admitted.

Mr. HOOKE produced a new kind of reflecting telescope of his own contrivance, differing from that of Mr. NEWTON in this, that the observer looked directly at the object erected. This was performed by a way propounded by MERSENNUS, and repeated in Mr. GREGORY's Optics; but was thought to have been never actually done before.

Dr. GREW shewed his microscopical observations on the trunk of an oak and elm, much differing from one another in the position of their parts and vessels. He was desired to shew at the next meeting his observations of the trunks of some other trees.

Mr. AWBREY presented some written observations concerning winds, their blowing down many hundreds of oaks at once, their blowing very differently in places little distant from one another, &c.

Mr. OLDENBURG read a Latin letter to himself from Monsr. CHRISTOPHER SANDIUS, dated at Hamburg, 15th December, 1673^c, giving notice of the manner of the generation of pearls, viz. that originally they are the eggs of a kind of oyster, which ejects them to breed other oysters of the same kind, but sometimes keeps one or two of them sticking to the sides of its shell, where, to the trouble of the breeding fish, they grow and become pearls of different sizes and shapes.

It was ordered, that the writer of this letter should be thanked, and desired to let the Society know what ground he had for the truth of the matter of fact.

Dr. KING, according to his promise, produced a piece of an artery of a bullock, as it is described by Dr. WILLIS, in his late book *De Medicamentorum Ope-*

^b Letter-book, vol. vii. p. 2. It is printed in the Philof. Transact. vol. viii. n° 100. p. 6179. for January and February 1674.

^c Letter-book, vol. vi. p. 346. It is printed in the Philofoph. Transact. vol. ix. n° 101. p. 11. for March 1674.

rationibus in humano corpore, shewing the four several membranes, of which it consists, viz. the vasculous, glandulous, muscular, and that which is contiguous to the blood; asserting withal the doctrine of Dr. WILLIS, that the motion of an artery is muscular, and the same with that of the heart.

An experiment was made with Mr. LISTER's styptic liquor upon a dog, by opening one of his crural arteries lengthwise without cutting it asunder. The water was renewed three or four times, and at the end of about a quarter of an hour and a half the blood seemed to be stopp'd; whereupon the dog was set at liberty, and committed to the care of the operator.

February 12. At a meeting of the council were present

The lord viscount Brouncker, president,

Sir JOHN LOWTHER,

Mr. HILL,

Sir WILLIAM PETTY,

Mr. CREED,

Sir ROBERT SOUTHWELL,

Mr. OLDENBURG.

Mr. COLWALL,

It was ordered, that a discourse of Mr. ROBERT HOOKE about the stars be printed by JOHN MARTYN, printer of the Royal Society.

Sir WILLIAM PETTY and Sir CHRISTOPHER WREN were sworn vice-presidents of the Society by taking the oaths of allegiance and supremacy, according to the prescript of the additional charter.

Mr. COLWALL and Mr. HILL acquainted the council, that the Mercers company had declared, that they had at present no occasion for taking of any money; but the first they had, they would take the four hundred pounds of the Society, and pay interest for it.

Hereupon it was ordered, that the members of this council should be desired to inquire about a speedy and safe way of disposing of the four hundred pounds to the best advantage, and to report to the council concerning it at the next meeting thereof.

Mr. COLWALL produced a note from Dr. GASPAR NEEDHAM to himself, importing, that he desired henceforth to be excused from his obligation to the Society.

At a meeting of the SOCIETY on the same day,

The Society inspected the dog, upon whom the experiment had been made at the last meeting with Mr. LISTER's styptic water, and found the dog very well, and the wound in a manner quite healed up.

It was ordered, that Mr. LISTER be acquainted with the success of this experiment by a letter from Mr. OLDENBURG.

Mr. HOOKE made several trials with a loadstone, to find, whether the interposition of any body would hinder the power of its effluvia: and having by weight so poised a balance, fitted for this purpose, that the iron was made to hang at a certain distance from the loadstone, so as to leave some room for divers bodies to be interposed, it was found, that though a silver crown, a piece of glass of about the same thickness, and four twenty shilling pieces of gold, called guineas, were severally interposed between the iron and the magnet, yet the iron did not at all alter its distance, which at first it had by the poise.

It was ordered, that Mr. HOOKE should be desired to try by himself a good number of experiments upon this subject, and draw up an account of their success, and to communicate it to the Society, that so they might call for such of them as they should think good to be shewn before them.

February 19. There were made some more experiments with the magnet; viz. a small bar of steel, of about one inch in length, and about a quarter of an inch diameter, was so suspended, that the lower end was distant from the pole of a very good loadstone, and counterpoised by six grains. And by several trials it was found, that a plate of glass, six inches broad, and half an inch thick, a thin board of wood about the same bulk, a plate of spar about the same breadth and thickness, a cut of butter on a trencher, a pewter-plate, a set of brass-weights, a burning deal-board, a red-hot tile, a bright burning coal, the same also blowed, each of them interposed between the steel and loadstone, suspended as aforesaid, made no variation of the attractive virtue of the stone: nor did an onion, slit in two, and laid upon the same stone, nor the interposing of lead, glass, wood, silver and gold, all at once, make any manner of change, the attraction remaining constant.

Farther, by the interposing of a knife, the virtue of the loadstone was much diminished; but by interposing a little bar of iron, half an inch in length, endwise, it increased about a quarter of the strength.

The bringing of iron any wise near the stone weakened the attraction.

Dr. GREW shewed some microscopical observations made upon a piece of the stem of a holly, and upon that of a fig-tree, both very curiously represented.

He was desired to produce some more observations of this kind, at the next meeting.

Mr. OLDENBURG read a letter to himself from Monf. SLUSIUS, dated at Liege, 8th February, 1674⁴, N. S. containing an answer to the queries sent him by Sir JOSEPH WILLIAMSON; which letter is as follows:

⁴ Letter-book, vol. vii. p. 23.

" Nobilissimo & Clarissimo Viro

" D. HENRICO OLDENBURG, Societatis Regiæ Secretario

" RENATUS FRANCISCUS SLUSIUS.

" S. P. D.

" Quæsitæ tuæ philosophica, vir clarissime, misit ad me nuper excellentissimus legatus idemque vir humanissimus, quo ferme tempore tuas 29 Decembris datas accepi. Ad illa nunc respondebo paucis, rem totam uberius executurus, si mihi post hæc vel fide dignorum relatione, vel proprio experimento plura scire contigerit.

" Lapis calaminaris non circa Aquisgranum modo, sed & prope Namurcum pluribusque inter Sabim & Mosam locis effoditur. Nec soli Aquisgranenses artem aeris eo tingendi vindicare sibi jure possunt: est quippe hæc in patria Dionantium oppidum ad Mosam eo nomine & nunc, & olim (Cominæo teste) celeberrimum. De Thermis vero libellum edidit ab aliquot annis d. gallus FRANCISCUS BLONDEL, qui Aquisgrani medicinam exercet, & cujus diligentia nihil modo est quod addam, pauca in hoc genere expertus. Didici tamen a chemico experientissimo mihiq; amico, ex aquis thermalibus separari commune sulphur magna copia: deinde salem, qui neque communis sit, neque nitrosus, nec ulli illorum similis, quibus nomen fecimus, sed sui generis; insipidus quippe & minime lixiviosus, &c, ut ipse aiebat, siccus. Idem retulit, aquamodice primum albescere, colorem deinde ex cæruleo ac viridi mixtum insuere. Cremorem, qui illis supernatat, nitrosum non esse, sed potius fuliginis æmulum.

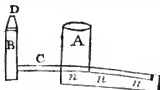
" Rectos fopinarum nostrarum carbonariarum puteos ad centum & ultra orgyiarum profunditatem deprimi, peritorum relatione mihi constat; atque inde obliquo itinere ferme adhuc orgyias totidem descendere. Quod fortasse mirum tibi videbitur V. C. cum 150 ulnarum profunditatem ad summum videaris agnoscere. Est autem orgyia (sive toisa) pugnorum viginti, ut loqui solent operarii, sive pedum sex.

" Aëris in fodinas deducendi (sic enim loquuntur) hæc est methodus. Prope rectum fodinæ puteum, fodiunt alterum multo minorem, aliquot orgyiarum intervallo. Hunc æqualiter cum primo deprimunt; & eum ad 16 vel circiter orgyias perventum est, cuniculum transversum inter utrumque puteum aperiunt. Cum puteus major deprimitur, deprimunt & minorem, & obstruunt priore cuniculo, alium inferiore loco substituunt; ita ut tum puteus uterque tum cuniculi semper παραλληλισμῶν servant; & hoc quidem eousque, dum puteus rectus est: cum vero in obliquum vergit, canalem quadratum ex asseribus compactum aptant ad os cuniculi, & undique obstruunt, ne quid aëris nisi per cuniculum ingredi possit. Canalem hunc ad putei oblique descendentis latus ap-

" pliant,

" plicant, & pro ratione descensus semper augent. Rudi schemate rem totam
 " tibi adumbrabo, quo me melius intelligas :

" A, est puteus major ; B, minor ; C, cuniculus
 " inter utrumque apertus ; n, n, n, canalis ligueus, quo aerem in fodinam obliquam ducunt.



" Solent autem puteo minori tuguriolum imponere, trunci conici figura, quale est D. & super clathris ferreis transversis ad profunditatem aliquot orgyiarum, ut in B, ignem accendere, quo aer, ut aiunt, fortius trahatur. Quod si aerem excludi, sive canalem obstrui, contingat, maximum operarii ab igne periculum est : bituminose nimirum ac sulphuree exhalationes densantur ac concrevunt, & a candelis fossorum concipiunt flammam, quæ mox miseros amburit. Ignem Græcum vocant nostrates, non inepte ; est enim inter hunc & illum similitudo non exigua. Brevi definit, sed malignus adeo remanet fœtor, ut non minore quam ipsa flamma noxam sæpe inferat ; vitam enim aliquando adimit. Non tamen in fodinis omnibus par periculum. In quibusdam enim nec adeo frequentes sunt exhalationes, nec tam cito in flammam erumpunt, nec si erumpant, fœtor adeo noxius sequitur.

" Aquas subterraneas, a quibus æquale, si non majus quam ab igne periculum est, (cum meminerim ad quadraginta una vice submersos) derivant in canales, publico, & privatorum etiam, sumtu constructos. Saltem si id fodinarum situs altior concedat, quales sunt in vicinis montibus, ex quibus fontes in hæc urbem defluunt : sin minus, vel situlis hauriunt, vel antlis, quales apud Agricolam in lib. de *Re Metall.* videri licet.

" Venio nunc ad aquas Spadanas, quarum vires plurimum extulit *Spadacrenes* auctor, plurimum deprellet *HELMONTIUS*, in quem idcirco invehitur alter. Sed neuter, ut existimo, modum servat. Negari enim non potest humores viscidos ac tartareos incidere, obstructions tollere, ac sanare morbos, qui iis originem suam debent ; præsertim si viribus non omnino dejectis, & ex medici prudentis consilio bibantur : sed non æque constat, morbos omnes, quos enumerat, ab iis tolli, nisi forte κατὰ συμβεχθός. Idem dictum puta de calculo laborantibus ; testari enim possum a multis ejectos calculos minores per urethères delapsos, sed neminem novi, qui a vesica calculo curatus fuerit. Militis illius Itali historia refertur ab auctore *Spadacrenes*, & ætatem meam antecedit. In toto illo tractu, qui apud nos vetus *Arduenne* nomen retinet, homines plerumque sunt μακροβίοι, & minime morbis obnoxii. Scaturiunt etiam multis in locis fontes Spadanorum æmuli, minoris quidem famæ, sed virtutis, ut intellexi, non minoris. An vero his sanitatem & vitæ diuturnitatem debeant incolæ, an potius vivendi rationi, & soli naturæ, plane mihi incompertum est. Parum enim fertilem terram colunt, & quæ ipsorum laboribus maligne respondeat ; delicias nesciunt, atque ab adolescentia duram & exercitam vivendi rationem

"nem festantur. Ebrietatem aliquam potis aquis accidere, testari possum; sepius illam expertus, sed levem, nec diuturnam. Idque aliquando mihi in memoriam revocavit quod legeram apud ANTICONUM *Ἐν ἱερῶν παραθεῖς συναινεῖν*, de aquis acidis, quarum potores THEOPOMPUS auctor est *ὡς ἐν ζῆν ὄντι* *ἀλλοιῶται*. Comune quoque est omnibus, qui Spadanus bibunt, fordes atro colore foedas deponere, sed non vomere, nisi vel sint *κακογεμαχοί*, vel supra modum sese ingurgitent, vel ex Geronsterio bibant; hic enim vomitum plerumque movere solet. De cantu fontis Sanenirii nihil haecenus intellexi, sed Deo, bene juvante, inquiram. Optimo FRAMBESARIO fucum factum fuisse existimo; nam experientia me docuit, aquas Sanenirii non minus quam cæterorum transferri posse. Inquiram pariter de sodinis Franchimontanis, quarum non nisi generalem modo noticiam habeo. De sale, qui ex his aquis elici potest, vide, si placet HELMONTIUM, qui illum, si recte memini, esurinum appellat: paucis omnino est, nec credo ELICHMANNUM illo medelas suas, ut tibi relatum est, perfecisse. Celebrabantur hic quoque ante annos viginti catapota ex aquarum Spadanarum sale; sed tandem reprehensum est, nihil omnino illius continere. Et si tanti est, ecce illorum compositionem R. vitrioli martis 3i tartari vitriolati 33, fucci liquiritiæ inspiissati q. s. addunt quidam scammon. præpar. 3ij ut cathartica fiant; nam, absque eo, deobstruant tantum, non purgant: dosis est duo vel tria pisi mediocris magnitudine. Sed hæc sunt alterius fori. Literis tuis respondere decreveram, verum jam epistolæ modum excessi. Vale itaque, vir nobilissime, meque tui semper observantissimum ama, ut soles, & cum ad clarissimum WALLISIUM scribes, plurimam illi nomine meo salutem adscribito. Dabam Leodii 8 Feb. 1674."

Mr. Hooke produced a quadrant of four inches diameter, with telescopic sights, to be made use of by two observers, and distinguishing to minutes.

He was put in mind of his other quadrant, whereby parallaxes, refractions, &c. may be observed in seconds by one observer.

February 26. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
Sir JOHN LOWTHER,	Mr. Hoskyns,
Sir WILLIAM PETTY,	Mr. Hill,
Sir CHRISTOPHER WREN,	Mr. Creed,
Mr. Colwall,	Mr. Oldenburg.

Mr. Hoskyns was sworn as a member of the council.

Sir JOHN LOWTHER having made a report of the sums, which he had received, in soliciting the arrears of some of the fellows of the Society, and taken notice, that some had pretended, that they had been long absent out of England; others, that they had been drawn into the Society contrary to their inclination; others, that they had been ignorant of the duty of weekly contributions; he therefore desired to be instructed what answer to give to such excuses.

It was resolved thereupon, that it should be left to the discretion of the committee, how to proceed with such persons; and that they should endeavour to get what they could of such arrears. And in the mean time it was thought advisable to solicit those first, who were most likely to pay the whole of their arrears, and then to take part from those, who were unwilling to pay all.

It was ordered, that the council be summoned again, to meet the next day, at four in the afternoon, at Arundel House, farther to advise with the earl marshal, about soliciting the arrears of the lords, who were members of the Society; as also to consider about putting into better order and use the library, which his lordship had bestowed on the Society.

At a meeting of the SOCIETY on the same day,

Mr. HOOKE shewed an experiment of the inclination of the lines of direction to the axis of the terrella; which he performed by placing a terrella in an hemispherical hole cut in a round table, and ordering the terrella so, that the axis lay level with the surface of it. Upon the surface of this table was placed a large skin of parchment, stretched on a hoop like a drum head, in the middle of which was cut a circular hole, just big enough to receive the terrella. Upon this parchment were sifted fine filings of iron, which by the gentle vibration of the extended parchment soon ranged themselves into magnetical ovals, which were thought to be all of an oval figure, and of ovals of one kind, but of different bigness, and all of them to touch the axis in the center of the loadstone. But these being only conjectures, and not certainly verified, it was thought proper, in order to the clearer and more certain discovery thereof, that there should be other methods attempted to make it out; which Mr. HOOKE propounded, and engaged to have at least some of them ready against the next meeting.

He observed farther, that a loadstone being moved to and fro under the parchment, on which the filings lay scattered, those filings all rose up, like so many bristles, making an appearance, as if the loadstone had been seen through the parchment.

He likewise applying a loadstone close to a small piece of tin, the stone seemed to hold it both after it was rubbed, and without rubbing.

He suggested also the making of experiments with a capped and uncapped loadstone, interposing a single paper between it and a piece of tin.

He was desired also to shew some of these experiments at the next meeting.

February 27. At a meeting of the COUNCIL at Arundel House were present

The lord bishop of Salisbury vice-president, in the chair,	
The earl marshal,	Sir PAUL NEILE,
Sir JOHN LOWTHER,	Sir WILLIAM PETTY,

5

Sir

Sir ROBERT SOUTHWELL,
Mr. HILL,

Mr. CREED,
Mr. OLDENBURG.

It was ordered, that Mr. EDWARD BERNARD, Savilian professor of astronomy at Oxford, having desired by Mr. HOOKE the loan of a Diogenes Laertius, and of a Coptic Psalter, out of the library bestowed upon the Society by the earl marshal, be accommodated with the said book for the space of a month, he giving bond of an hundred pounds to the Society, to restore those books at the end of the said month, to be accounted from the date of this order: and

That Mr. HOOKE take care of having the catalogue of the Arundelian library completed within a month, and to have a duplicate made thereof.

The earl marshal took a list of some of the noblemen of the Society, who were deep in arrears, as the duke of Buckingham, marquis of Dorchester, earl of Dorset, earl of Northampton, earl of Peterborough, earl of Carlisle, lord viscount Yarmouth, lord CAVENDISH, and Mr. EDWARD HOWARD.

He named upon occasion Mr. THOMSON and Mr. NELTHROP as very good men to put the four hundred pounds legacy to upon use at 6 per cent.

March 5. The president and all the vice presidents being absent, the Society did not sit; yet Mr. HOOKE repeated the magnetical experiment, which had been made at the last meeting, and which seemed to confirm that phenomenon of the magnetical orbs ranging themselves into elliptical figures.

There were also made some experiments with a loadstone, capped and uncapped, viz.

The south end of an uncapped magnet, with a single paper between it, and a small bar of steel suspended, held the said bar with four drachms and fifteen grains.

The same south end capped, without paper, held the said bar with seven ounces and one drachm.

The same south end capped, with a single paper interposed, held that bar, with one ounce, five drachms, and an half.

March 12. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	Mr. COLWALL,
The lord bishop of Salisbury,	Mr. HILL,
Sir JOHN LOWTHER,	Mr. CREED,
Sir WILLIAM PETTY,	Mr. OLDENBURG.
Sir CHRISTOPHER WREN,	

There was read a letter from the earl marshal to Mr. OLDENBURG, wherein his lordship proposed a method of well disposing the four hundred pounds legacy to some considerable citizens, with whom his friends had lodged considerable sums of money.

The council having debated this matter, thought proper to refer the determination thereof to another meeting of the council, ordering, in the mean time, that their hearty thanks should be given to the earl marshal for his care of the concerns of the Society.

At a meeting of the SOCIETY on the same day,

Mr. HOOKE endeavoured to shew a new way of making a loadstone set itself north and south; which was, by suspending it by a string fastened to the two ears of a cap, like the cap of a magnetical needle, which was convertible upon the sharp point of a needle. But the contrivance not proving tender enough, he was desired to fit it better for the next meeting.

He intimated a theory for finding the loadstone's variations all over the world, and promised to make an apparatus for it against the next meeting, and particularly a rete for the magnetical meridian.

The experiment about the inclination of the magnetical direction to the axis of the terrella being again made, and those lines considered, several of the members doubted whether they were ovals of one kind. Mr. HOOKE was therefore desired to contrive some method of determining this point.

Dr. GREW produced two intire microscopical observations, about the texture of a piece of a trunk of a Walnut-tree, and of one of the trunks of a hazel-tree.

Mr. OLDENBURG presented his 8th volume of the *Philosophical Transactions* for 1673.

There were also presented by Mr. OLDENBURG, from Mr. REID of Lugwarein in Herefordshire, some red-streak grafts, of which those members of the Society, who had opportunity to propagate that cider-fruit, took what quantities they had occasion for.

March 19. Mr. HOOKE gave an account of a theory for finding the variation of the magnetic needle all over the world; of which he said, that he knew not, whether it was coincident with that of Mr. HENRY BOND, who many years before had pretended to know such a theory*; whence he could likewise deduce the longitude.

* See an account of his undertakings on this subject, in the *Philosoph. Transact.* vol. viii. n° 95. p. 606; for June, 1673.

The substance of Mr. HOOKE's theory is, that the magnet hath its peculiar pole, distant ten degrees from the pole of the earth, about which it moves; so as to make a revolution in three hundred and seventy years: whence the variation hath altered of late about ten or eleven minutes every year, and will probably so continue to do for some time, till it begins to grow slower and slower, and will at length be stationary and retrograde, and in probability may return. But whether it be so or not, or whether it proceeds in a meridian, or in a parallel or great circle, or any other irregular curve, and if in a curve, whether its concave or convex sides be towards us, more time and observations must make clear. But it seems most probable, by comparing several declinations, observed by capt. JAMES¹ and others, that the progress of this magnetical north pole is from west to east beyond the north pole.

Mr. HOOKE proposed the making of an easy and nice instrument, for observing exactly the variations of the needle in many different parts of the world; and he was desired to procure it to be made.

Mr. OLDENBURG read two letters written to him; one in Latin from CHRISTOPHER SANDIUS, dated at Hamburg 27th February, 167 $\frac{1}{2}$ ², containing the authority, which he had for asserting such an origin of pearls, as in his former letter of 15th December, 1673, he had delivered.

The other was from ANDREAS MULLERIUS at Berlin, without a date, containing an offer of an anonymous person, of furnishing a key of the Chinese language, for a recompence; and that key to be learned with great ease and expedition, even by ordinary capacities.

It was ordered, that the writer of this letter be desired to send the Society a specimen of his performance by means of his invention.

1674, March 26. RENATUS FRANCISCUS SLUSIUS, canon of Liege, was proposed candidate by Mr. OLDENBURG, upon a letter of his, dated $\frac{1}{17}$ March, 167 $\frac{1}{2}$ ³.

Signor PACICHELLI, a Roman abbot, then at Colen, and highly commended by Mr. OLDENBURG, was proposed candidate by Mr. BOYLE.

Mr. HOOKE repeated his discourse made at the last meeting, concerning an hypothesis for solving the phenomena of all the variations of the magnetical needle all over the world; as also his purpose of preparing an easy and accurate way, to be sent abroad, for making exact magnetical observations.

He was desired to begin himself, by making good observations of the needle's

¹ Captain THOMAS JAMES, whose voyage for the discovery of a north west passage into the South Sea, was printed at London, 1633, in 4to.

² Letter-book, vol. vii. p. 35. It is printed in the Philosoph. Transact. vol. ix. n. 101. p. 11.

³ Letter-book, vol. vii. p. 49.

variation here; and, in order thereunto, to fix a certain meridian at Gresham College; which he undertook to do by the north star.

Dr. DANIEL COX's paper, concerning his way of extracting volatile salts and spirits out of vegetables, was read, and much applauded; and he being absent, it was ordered, that Mr. OLDENBURG should give him the hearty thanks of the Society; and that this discourse should not only be registred¹, but likewise forth-with printed².

Mr. BOYLE remarked, that to his knowledge the Dr. had been master of this way eight years before.

April 2. Mr. HOOKE shewed some experiments, concerning the various ways, that the magnetical effluvia bend and inflect themselves, by putting divers strait steel bars in the pole of the magnet, some shorter, some longer, some close to it, some at a distance, some in direction, some cross-wise; the effect whereof was, that the filings of iron being stirred by gentle knockings of the extended parchment, ranged themselves into oval or curve figures about the bars, but in a quite different form from what they would have received, had those bars of iron been loadstones of the like shape; that is, the poles seemed to lie in these, where the equinoctial would have been in a magnet, and the equinoctials of these would have been the poles of loadstones of like shape.

He promised to prosecute these experiments, by applying bodies of iron of other figures to the terrella.

He mentioned also, that whereas a loadstone would attract a red-hot iron, steel would not be at all affected by it.

Dr. GREW shewed his microscopical observations on the trunks of apple, pear, and plum-trees, and promised to bring in an account of these and his former observations.

Mr. OLDENBURG read a letter to himself from Mr. LISTER, dated 12th *March*, 1674¹, giving an account of an observation of Dr. JOHNSON of Pontefract, concerning some stones of a perfect gold colour found in animals.

April 9. The Society did not meet.

April 16. The Society did not meet.

April 23. Mr. HOOKE shewed by a microscope the inward texture of a bull-rush, consisting of pipes interwoven from one end to the other, in the manner of a hurdle, or resembling loose needle-work.

¹ It is not in the Register.

² It is printed in the *Philosoph. Transact.* vol.

³ It is printed in the *Philosoph. Transact.* vol. ix. n^o 101, p. 9 for March, 1674.

ix. n^o 101. p. 4. for March, 1674.

He made an experiment for discovering, whether a bar of steel, touched by the immediate contact of a loadstone would more strongly move to it, than untouched. It was found, that the steel suspended at a balance, and counterpoised, when thus touched, bore the same weight when untouched.

He likewise produced a quadrant with telescopical sights, wherein appeared the pre eminence of such sights above the common dioptra's.

Mr. OLDENBURG read a letter to himself from Mr. HEVELIUS, dated at Dantzick, 26th March, 1674^a, giving an account of the manuscripts of KEPLER, purchased by the said HEVELIUS, with a defence of the *Dioptra* hitherto used by himself, and alledging some difficulties in the use of telescopical sights. Further, giving notice, and sending an epitome of a new astronomical theory, advanced by Dr. WASMUTH, professor of the oriental languages in the university of Kilo in Holstein, who intended to publish a book of it, with this title, *Annales Celi & Temporum perpetui; sive Mysteria Astronomico-chronologica, a seculo abscondita, nunc per Dei gratiam detecta & evidenter asserta libris tribus*. In this letter Mr. HEVELIUS describes a phenomenon seen by himself about Marienburgh in Prussia, 5th February, 1674, wherein the sun appeared with a very long tail, and a mock-sun directly under him^b.

Lastly, He signified, that the French astronomers had observed the sun to have no parallax at all.

To the last part of this letter Mr. HOOKE said, that it was desirable to know by what method the French astronomers had made that observation of the sun's having no parallax at all; that he was persuaded, that if the observations were made with telescopical sights, some, though a very small, parallax of the sun would be found; and that by the naked eye, be the instruments never so accurate, one cannot observe to less than a minute; whereas that parallax will scarce perhaps amount to a quarter of a minute.

April 30. Mr. HOOKE excused himself, that his quadrant formerly promised was not yet ready.

He made an experiment, whether an iron ring would, by any magnetical virtue, be kept in a posture encompassing the terrella at equal distance. And it was found, upon making several essays with the said ring, that at length it rested about the terrella unmoved, lying upon a board in water. This was tried, to see whether any thing could be found here below analogous to the circle about the planet Saturn.

It was moved, that experiments might be made, to find,

^a Letter-book, vol. vii. p. 71. Part of it is printed in the Philosoph. Transact. vol. ix. n° 102.

p. 27. for April, 1674.

^b Philosoph. Transact. n° 102. p. 26.

1. Whether all parts of the terrella have an attraction directly towards its center?

2. Whether, if there be any such attraction, that attraction be in all places of the terrella of equal strength; for instance, in the æquator as strong as in the axis?

3. Having by trials found, what the approaches of magnetical bodies to the magnet are, according to the different position of the magnet, perpendicular, horizontal, and oblique; to endeavour to find out, since the approaches are made in a curve line, what kind of curve it is?

Mr. HOOKE suggested, that the best dipping-needles may be made in water, because the water takes off the gravity; as also, that a pipe of iron should be made of equal gravity with water dipping.

Mr. OLDENBURG read a copy of a letter written to Mr. HEVELIUS by Dr. WASMUTH*, importing, that the said Dr. rejecting all the three famous hypotheses of astronomy, had pitched upon another, of his own invention, viz. of solving all the irregularities and phenomena of the celestial motions by a spiral line.

Mr. HOOKE intimated, that this hypothesis was not new, the lord chancellor BACON having used it in his *Opuscula*. And Mr. OLDENBURG added, that he had found the same in the *placita Philosophica Quarini*, who had adopted and maintained the same theory.

There being many other very magnificent promises in this letter of Dr. WASMUTH, the sense of the members present seemed to be, that he had promised too much to answer expectation.

May 7, 14, 21, and 28. there was no meeting of the Society.

June 4. Mr. OLDENBURG presented to the Society four books; viz. 1. From Mr. BOYLE, intituled, *About the Excellency and Grounds of the mechanical hypothesis some Considerations proposed to a friend by R. B. E., Fellow of the Royal Society*, printed at London. 1674, in 4to. 2. *Navigation and Commerce, their Original and Progress; containing a succinct account of Traffick in general, its Benefits and Improvements; of Discoveries, Wars, and Consists at sea, from the original of Navigation to this day, with special regard to the English Nation; their several Voyages and Expeditions unto the beginning of our late Differences with Holland: in which his Majesty's title to the Dominion of the Sea, is asserted against the novel and late pretenders:* by JOHN EVELYN, Esq; F. R. S. printed at London, 1674, in 8vo. 3. *Icones & Descriptiones rariorum Plantarum Siciliae, Melitae, Galiae, & Italiae, Auctore PAULO BOCCONE, Panormitano Siculo:* printed at Oxford, in 1674.

* Letter-book, vol. vii. p. 87. It is printed in the *Philosoph. Transact.* vol. ix. n° 104 p. 74. for June, 1674.

4. *Recherches & Observations Naturelles*, by the same author: printed at Amsterdam, 1674, in 8vo.* With these two last books, there were presented also from the author three curious pieces of coralline substances, for the repository of the Society.

Mr. OLDENBURG read a discourse of Dr. DANIEL COXE, concerning vitriol*, tending to discover the nature of that substance, and to give farther light in the inquiry into the principles and properties of their minerals. This discourse was highly applauded, and the author was desired to continue his experiments and observations on that subject.

Mr. HOOKE being called upon for his new astronomical quadrant, said, that he hoped, that it would be finished very soon: and being desired to acquaint the Society with the performances to be expected from this instrument, he answered,

That it was a quadrant so contrived, as to perform what could be required from any astronomical instrument; the particulars whereof he intended shortly to publish in print. He was desired to hasten the finishing of so noble and so useful an instrument; and to get it ready, if possible, against the next meeting.

He was put in mind of preparing such experiments as might determine those particulars, which were suggested by him 30th April, 1674.

June 11. The Society did not meet.

June 18. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
Sir CHRISTOPHER WREN,	Mr. HILL,
Sir ROBERT SOUTHWELL,	Mr. CREED,
Mr. COLWALL,	Mr. OLDENBURG.

The president proposed, that, considering the small number of members, who attended the weekly meetings of the Society, by reason of the season of the year, wherein many go into the country, the fixed meetings be adjourned till autumn: and that in the mean time the council might sometimes meet, and consider of a better way than hitherto had been used, to provide good entertainment for the said meetings, by establishing lectures grounded upon, and tending to experiments.

At a meeting of the SOCIETY on the same day,

The Society was adjourned till the president should send out summons to return to their weekly meetings. In the mean time the council were to consider of a method of prosecuting the work of the Society with more vigour than had been done of late.

* It is printed in the Philof. Transact. vol. ix. n° 103. p. 41. and n° 104. p. 66.

August 27. At a meeting of the COUNCIL were present

SIR WILLIAM PETTY vice-president, in the chair,	
SIR JOHN LOWTHER,	SIR PAUL NEILE,
SIR JOHN CUTLER,	MR. OLDENBURG.
SIR CHRISTOPHER WREN,	

It was considered by this council, that to make the Society prosper, good experiments must be in the first place provided, to make the weekly meetings considerable, and that the expences for making these experiments must be secured by legal subscriptions, for paying the contributions: which being done, the council might then with confidence proceed to the ejection of useless members.

September 29. At a meeting of the COUNCIL were present

SIR WILLIAM PETTY, vice-president, in the chair,	
SIR ROBERT SOUTHWELL,	MR. COLWALL,
DR. GODDARD,	MR. OLDENBURG.

It was ordered, that there should be prepared a form of a legal subscription, for paying fifty-two shillings a-year.

SIR WILLIAM PETTY proposed, that there might be drawn up some thing, that might effectually tend to put new vigour into the meetings of the Society, and to bring in the arrears, by representing, that the council having considered the present condition of the Society, arising from the want of good experimental entertainment at their meetings, and from the neglect of the members in paying their weekly contribution, had thought it necessary to fix a certain number of fellows, able and willing to entertain the Society every week, with a considerable experimental discourse; and for the defraying of the expence necessary for the making of experiments, to appoint a solicitor to call in their arrears, and to acquaint such as are in arrears with the obligation, which they had subscribed to upon their admission, and with the Society's intention of proceeding to a legal recovery of their arrears against such, as should refuse or delay the payment thereof.

October 7. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
SIR JOHN LOWTHER,	DR. WALTER NEEDHAM,
SIR WILLIAM PETTY,	DR. CREED,
DR. GODDARD,	MR. OLDENBURG.
MR. COLWALL,	

It was ordered, that as many of the fellows, as were willing to further the business of the Society, should be desired to advance a year's weekly contribution, for carrying on the work thereof with more vigour than hitherto; and that Sir
WILLIAM

WILLIAM PETTY be desired to draw up a declaration to recommend the said advance accordingly : •

That such of the fellows, as regard the welfare of the Society, should be desired to oblige themselves to entertain the Society, either *per se* or *per alios*, once a year at least, with a philosophical discourse grounded upon experiments made or to be made; and, in case of failure, to forfeit five pounds. And that Sir WILLIAM PETTY be likewise desired to draw up a form of such an obligation, as may bind in law : and

• That Sir JOHN LOWTHER, Sir WILLIAM PETTY, and Mr. HOOKE do meet together, and consider of a safe and beneficial way of putting out the four hundred pounds, left by the late Dr. WILKINS, bishop of Chester.

Mention was made of finding out a fit person to call in the arrears, after that the meetings of the Society shall have been made more considerable by experimental entertainments : as also of thinking of a way to put Chelsea College and the land to some use.

October 15. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,

Dr. GODDARD,

Mr. COLWALL,

Mr. CREED,

Mr. OLDENBURG.

The two draughts of the declaration for restoring the Society, brought in by Sir WILLIAM PETTY and Dr. GODDARD were read, and the substance of both reduced into one paper, which the amanuensis was ordered to transcribe fair for farther consideration at the next meeting of the council.

It being represented, that the permitting of such, as are not of the Society, to be present at the meetings thereof, is both troublesome and prejudicial to the same, it was ordered, that the repeal of that statute, which allows such an admission, and which is the second of the fourth chapter, containing the statutes about the ordinary meetings of the Society, shall be propounded at the next meeting of the council.

It being likewise represented, that the liberty of divulging what is brought in to the meetings of the Society is also prejudicial to the same, and renders divers of the members thereof very shy of presenting to them what they have discovered, invented, or contrived; it was moved, that a form of a statute might be prepared, injoining secrecy to the members of the Society in such matters, as shall be brought in, and by the president or vice-president declared to be kept secret, as the communicators desire.

A form to this end was proposed as follows :

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“ Every

" Every fellow of the Royal Society shall make a solemn promise before the same, not to discover, directly or indirectly, to any person, not being of the Society, such observations, experiments, or other communications, as shall be brought in to the meetings of the same, and there by the president or one of the vice-presidents declared to be kept secret, at the desire of the communicator."

The time of the summoning of the Society to return to their weekly meetings being spoken of, it was resolved, that since the 29th of October¹, and the 5th of November, falling both upon a Thursday, which is the Society's meeting-day, would prove inconvenient for their meetings, the said summons should be made for the 12th of November; and to the end that the fellows might have notice what of late had been considered and done by the council in order to put life into these meetings, it was concluded upon, that the form of these summons should be as follows: viz.

" These are to give notice, that the Royal Society intends to return to their public meetings on Thursday the 12th of November instant, 1674, in Gresham College, at three of the clock; at which time the company will be entertained with an experimental exercise by their president, the lord viscount Brouncker, or Dr. Wallis. The like will be performed the next meeting-day, being the 19th of November, by the honourable Robert Boyle, and the 26th of the same month by Sir William Petty, or, in the absence of any of them, by Mr. Robert Hooke their curator by office; in order to a vigorous prosecution of the ends of their institution; touching which the intentions of the council of the said Society will be farther declared on the day of their anniversary election, being the 30th of this instant November."

Memorandum: To consider of the four hundred pounds legacy, and Chelsea College, at the next meeting.

October 19. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,	
Sir ROBERT SOUTHWELL,	Mr. COLWALL,
Dr. GODDARD,	Mr. OLDENBURG.

The business of engaging the members of the Society to enter into a legal obligation, in reference to their weekly payments, and the declaration drawn up by Sir WILLIAM PETTY and Dr. GODDARD, and the form also for summoning the Society to return to their weekly meetings being again considered of, as the main things to be determined with all possible speed; it was ordered, first, that Sir ROBERT SOUTHWELL should be desired to apply himself to the attorney-general², and to desire his advice in drawing up such a form, as might be binding in law:

¹ The day of the inauguration of the lord mayor of London.

² Sir FRANCIS NORTH, afterwards lord keeper of the great seal.

Secondly,

Secondly, That the declaration and the form of summons belikewife read again, and considered of at the next council.

Mr. Hooke acquainted the council, that Sir JONAS MOORE had been with him at Chelsea College, and made an overture of engaging a gardiner, a sufficient man, to take a lease of the house and land about it, for a considerable number of years, on condition of repairing the house and wall in the land, and paying a yearly rent for it; allowing withal to the Society a power to make hortulan experiments there; as also to build an astronomical observatory; which latter Sir JONAS MOORE himself would undertake to do at his own charges, to the value of an hundred and fifty or two hundred pounds.

This proposition was well accepted by the council, and Mr. Hooke was desired to prosecute the business, by urging Sir JONAS MOORE to proceed farther in this affair.

The legacy of the four hundred pounds being also again considered of, and Sir WILLIAM PETTY having made an overture of laying out that sum upon a house of the late captain GRAUNT in Birchen Lane, the council desired, that Sir JOHN LOWTHER, Sir WILLIAM PETTY, and Mr. Hooke would meet together and ripen that business.

It was voted, that the second statute of the fourth chapter of the book of statutes be repealed; and it was repealed and made void accordingly.

October 30. At a meeting of the COUNCIL were present

The lord bishop of Salisbury, vice-president, in the chair,	
Sir JOHN LOWTHER,	Mr. GODDARD,
Mr. COLWALL,	Mr. OLDENBURG,
Mr. HOSKYNs,	

The form of the summons to the Society for returning to their weekly meetings being read again, it was thought fit to omit the names of the persons, who were to entertain the Society, and to let it be as follows:

"These are to give notice, that the Royal Society intends to return to their public meetings on Thursday, being the 12th of this instant November, 1674, in Gresham College, at three of the clock; at which time and the following days of their meetings the company will be entertained with experimental exercises, to be performed by several eminent members of the same, in order to a more vigorous prosecution of the ends of their institution; touching which the intentions of the council of the said Society will be farther declared on the day of their anniversary election, being the 30th of this instant November."

This was ordered to be forthwith committed to the press:

The form for a new subscription, drawn up by the attorney-general, was read and

and approved of; and it was ordered, that Sir ROBERT SOUTHWELL be thanked for his care in procuring it, and withal desired to acquaint the attorney-general with the acknowledgments of the council for this his favour.

The declaration drawn up by Sir WILLIAM PETTY and Dr. GODDARD was read again: whereupon it was mentioned, that Sir ROBERT SOUTHWELL had taken a copy of it, in order to shew it to the lord keeper.

Mention was again made of two propositions, one made by Sir WILLIAM PETTY, relating to the putting out of the four hundred pounds legacy; the other by Sir JONAS MOORE, concerning the letting out of Chelsea-College.

Both being well accepted of, it was thought necessary, that both the proposers should be desired to put their respective propositions in writing, that so both the busineses, to which they related, might with the more certainty and vigour be put in execution.

A memorandum of business for the next meeting:

1. About printing the form of a new subscription.
2. Sending out one to call in money.
3. Renewing the order for the treasurer's deputation.
4. What to do with the declaration.
5. To think of more entertainers of the Society.

November 9. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,

Sir JOHN LOWTHER,

Mr. HILL,

Sir WILLIAM PETTY,

Mr. GODDARD,

Sir ROBERT SOUTHWELL,

Mr. COLWALL,

Mr. HOSKYNs,

Mr. OLDENBURG.

The form of the new subscription was agreed upon, as follows:

“ I A. B. do grant and agree to and with the president, council,
 “ and fellows of the Royal Society of London for improving natural knowledge,
 “ that so long as I shall continue a fellow of the said Society, I will pay to the
 “ treasurer of the same for the time being, or to his deputy, the sum of fifty-
 “ two shillings *per annum*, by four equal quarterly payments, at the four usual
 “ days of payment, that is to say, the feast of the nativity of our Lord, the feast

* MESSAGE lord FINCH.

" of the annunciation of the blessed Virgin MARY, the feast of St. JOHN BAPTIST, and the feast of St. MICHAEL the archangel, the first payment to be made upon the next ensuing the date of these presents: and I will pay in proportion, viz. one shilling per week for any lesser time, after any of the said days of payment, that I shall continue fellow of the said Society. For the true payment whereof I bind myself and my heirs in the penal sum of twenty pounds. In witness whereof I have hereunto put my hand and seal this day of in the year

" Sealed and delivered in
" the presence of

Mr. HOOKE's discourse containing *Animadversions on the first part of Machina Cœlestis of the deservedly famous astronomer, JOHN HEVELIUS, &c.* was licensed for the press.

N^o 107 of the *Philosophical Transactions* was also licensed.

Sir ROBERT SOUTHWELL redelivered to the council the declaration, which had been drawn up for the new regulating the Society, after he had read it to the lord keeper, who, he said, well approved of it; and withal expressed his readiness to serve the Society, and particularly in doing them good offices about his majesty.

Sir ROBERT SOUTHWELL was thanked by the council, both for this care, and that other of procuring for them from the attorney general the legal form of subscription, inserted above; and he was desired, in the name of the council, to assure the lord keeper and attorney general of the deep sense, which the council had of their favour to the Society, and their regard to the welfare of the same.

Sir WILLIAM PETTY proposed in writing several ways of disposing the four hundred pounds legacy. One was the inheritance of about eighty pounds *per annum* rent in ground and houses in Hog-lane near long-alley in Moor-fields, and about eight pounds *per annum*, at Erith in Kent, which was then under mortgage for three hundred and fifty pounds, with about fifteen pounds arrears of interest. There was a claim of a dower on the premises, which might be had for under one hundred and fifty pounds.

The other way was, a house, viz. the Seven Stars in Birchin-lane, in lease to RICHARD HUTSON, who paid ninety-five pounds fine, and fifty pounds *per annum*, of which lease nineteen years and a half were then unexpired; which house was a lease of thirty-eight years yet to come; one of which a ground-rent of fourteen pounds *per annum* was to be paid.

Mr. HOOKE was desired against the next meeting of the council to view the place in Hog-lane, whether the houses were in good repair, and likely to be tenanted,

Sir

Sir WILLIAM PETTY was desired to engage Mr. BARLOW, the picture-drawer, to collect the arrears due to the Society; and that the said Sir WILLIAM, and Mr. HOSKYNs, do join in taking good security from Mr. BARLOW; and this being done, to direct him to Mr. COLWALL, the treasurer, to receive such instructions, as shall be requisite to render this business effectual, and particularly, to furnish him, under his hand, with the power of collecting the arrears in his name, according to a former order of the council, bearing date 5th January, 1674; which order was this day renewed to the said Mr. COLWALL.

Memorandum, that at the next meeting of the council it be considered, what persons might be engaged to entertain the Society in the month of December following: And,

That those intentions of the council, mentioned in the summons of the Society to return to their meetings, were chiefly, that now there are a legal subscription and a declaration, both subscribed by the council and some other members of the Society.

It was ordered, that two hundred and fifty copies be forthwith printed of the new form of subscription, and this, if possible, against the Thursday following.

November 12. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
The earl marshal,	Mr. COLWALL,
The lord bishop of Sarum,	Mr. HILL,
Sir JOHN L. WITHER,	Mr. HOSKYNs,
Sir WILLIAM PETTY,	Mr. OLDENBURG.
Sir ROBERT SOUTHWELL,	

A committee was appointed for auditing the accounts of the treasurer, consisting of the president, the two secretaries, Dr. GODDARD, and Mr. HOSKYNs: and it was left to them to meet at such time and place, as should seem most convenient to themselves.

The new form of a legal subscription for the weekly payments being again spoken of, it was thought necessary to make a statute concerning the same to this effect:

Every person continuing, or to be hereafter admitted, fellow of this Society, shall sign, seal, and, as his act and deed, deliver an obligation in the following words:

I do grant, &c. *

It being put to the vote by the president, whether this draught now agreed

* See the form above in the minutes of the meeting of the council of November 9.

upon

upon by the council should be read at another meeting, it was unanimously carried in the affirmative.

Memorandum. 1. To inquire of Sir WILLIAM PETTY, whether he had engaged and taken security of Mr. BARLOW the collector.

2. To inquire of Mr. HOOKE, whether he had viewed the house in hog lane.

3. To secure more persons, for experimental discourses after St. Andrew's day.

4. To mention Dr. PLOT's proposal recommended by Dr. WALLIS to the council.

On the same day the SOCIETY resumed their weekly meetings¹.

Dr. WALLIS presented them with, and read before them, *a discourse of gravity and gravitation grounded on experimental observations*, and having a reference to two books not long before published by an anonymous author², the one intitled *an Essay concerning Gravitation or Non-Gravitation of Fluids*³, the other, *Difficiles Nuges: or some Observations touching the Torricellian Experiments, &c.*⁴. The doctor was thanked for this discourse, which was ordered to be entered into the Register-book⁵.

It being, among other particulars in discourse upon the reading of Dr. WALLIS's paper, remarked, that the explication of the cause of springiness would contribute very much to illustrate the nature of air, Mr. HOOKE said, that he had considered that subject, and particularly to make a springy body out of a body not springy.

Mr. HOOKE was desired by the president, that if he should perform what he mentioned, he would present the Society therewith in a discourse: and being asked, whether he could promise to bring it in at the first meeting of the Society after the approaching holydays, he answered, that he would endeavour to do so.

Mr. OLDENBURG presented two small books, one in French from Charles Drelincourt, M. D. intitled, *La Legende du Gascon: ou la Lettre de Charles Drelincourt à Monsr. Porrée sur la Methode, pretendue nouvelle, de tailler la pierre: avec trois autres à Monsr. Vallot, premier Medecin de sa Majesté*, printed at Leyden, 1674, in 12°. The other from Dr. SCHRADERUS, intitled, *Observationes de Generatione Animalium & Anatomico-medica*.

Mr. OLDENBURG was desired to produce Mr. LEEWENHOECK's observations concerning air, blood, &c.

¹ They met at Gresham College.

² Sir MATTHEW HALE, lord chief justice of the King's Bench.

³ Printed at London in 1674, in 8vo.

⁴ Printed there the same year in the same form.

⁵ Vol. iv, p. 203.

November

November 19. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
Sir WILLIAM PETTY,	Mr. HILL,
Dr. GODDARD,	Mr. OLDENBURG.
Mr. HOSKYNs,	

The declaration was read, and ordered to be read again on the Monday following, November 23, for which time a meeting of the council was agreed to be summoned.

It being put to the vote, whether the draught of the bond, voted at the last meeting of the council to be read at another meeting, should pass into a law, it unanimously passed in the affirmative.

Mr. HOOKE was again desired to view the houses in Hog-lane proposed by Sir WILLIAM PETTY for laying out the four hundred pounds legacy upon, and to make a report to the council at their next meeting.

Mr. BARLOW, the designed collector, presenting himself to the council, was desired to bring in security, which he promised to do.

Persons to entertain the Society in December were pitched upon, viz. Mr. RAY, Mr. COLLINS, and Dr. SMITH; and Mr. OLDENBURG was ordered to speak or write to others concerning the business, and particularly to desire them to name their time, when they would be ready for such exercises.

Dr. ROBERT PLOT's design of making a survey of all England for compiling a history of nature and art in reference to that kingdom was well approved of; and Mr. OLDENBURG ordered to assist him in directing him to such of his correspondents in the country, as were likely to direct and instruct him in this undertaking.

Sir WILLIAM PETTY, Mr. HOSKYNs, and Mr. HOOKE, were ordered to take care of the proposal for disposing of the four hundred pounds legacy upon the houses and land in Hog lane.

It was ordered likewise, that the observations and experiments registered before and reduced to several lectures, to be read at the Society upon occasion.

At a meeting of the SOCIETY on the same day,

Mr. BOYLE presented to the Society by the hands of Mr. OLDENBURG his *Experimental notes of the mechanical origin or production of fixedness, as opposite to volatility*; which discourse was read and ordered to be registered* as follows:

* Register, vol. iv. p. 234.

" The qualifications, that conduce most to the fixity of a portion of matter, seem to be these :

" First, the grossness, or the bulk, of the corpuscles it consists of ; for if these be too big, they will be too unwieldy, and unapt to be carried up in the air by the action of such minute particles as those of the fire, and will also be unfit to be buoyed up by the weight of the air ; as we see, that vapours, whilst they are such, are small enough to swim in the air, but can no longer be sustained by it, when they convene into drops of rain or flakes of snow. But here it is to be observed, that when I speak of the corpuscles, that a fixed body consists of, I mean not either its elementary or its hypostatical principles, as such, but only those very little masses, or clusters of particles, of what kind soever they be, that stick so firmly to one another, as not to be divisible and dissipable by that degree of fire, in which the body is said to be fixed ; so that each of those little concretions, though it may itself be made up of two, three, or more, particles of a simpler nature, is considered here *per modum unius*, or as one intire corpuscle. And this is one qualification conducive to the fixedness of a body.

" The next is the ponderousness or solidity of the corpuscles it is made up of ; for if these be very solid, and (which solid and compact bodies usually are) of a considerable specific gravity, they will be too heavy to be carried up by the effluvia, or the action of the fire, and their ponderousness will make them as unwieldy and indisposed to be elevated by such agents, as the grossness of their bulk would make bigger corpuscles, but of a proportionably inferior specific weight. On which account the calces of some metals as gold, silver, &c. though by the operation of solvents, or of the air, or of both, reduced to powders exceedingly subtil, will resist such vehement fires, as will easily drive up bigger, but less heavy and compact, corpuscles than those calces consists of.

" The third qualification, that conduces to the fixity of a body, belongs to the internal parts, not barely as they are of several parts of it, but as they are aggregated or contexted into one body: for the qualification I mean is the ineptitude of the component corpuscles for avolation, by reason of their branchedness, irregular figures, crookedness, or other inconvenient shape, which intangles the particles among one another, and makes them difficult to be extricated ; by which means if one of them do ascend, others, wherewith it is complicated, must ascend with it, and whatever be the account, on which divers particles stick firmly together, the aggregate will be too heavy or unwieldy to be raised ; which I therefore take notice of, because, that though usually it is on the roughness and irregularity of corpuscles, that their cohesion depends ; yet it sometimes happens, that the smoothness and flatness of their surface make them so stick together as to resist a total divulsion ; as may be illustrated by what I have said of the cohesion of polished marbles and the plates of glass, and by the fixity of glass itself in the fire.

" From this account of the causes or requisites of fixity may be deduced the following means of giving or adding fixation to a body, that was before either volatile or less fixed. These means may be reduced to two general heads: first, the action of the fire, as the parts of the body, exposed to it, are thereby made to operate variously on one another: and next, the association of the particles of a volatile body with those of some proper additament, which term of *proper* I rather employ, than that one would expect of *fixed*; because it will ere long appear, that, in certain cases, some volatile bodies may more conduce to the fixation of other volatile bodies, than some fixed ones do: but these two instruments of fixation being but general, I shall propose four or five more particular ones. And first, in some cases it may conduce to fixation, that either by an additament, or by the operation of the fire, the parts of a body be brought to touch each other in large portions of their surfaces: for that from such a contact there will follow such a mutual cohesion, as will at least indispose the touching corpuscles to suffer a total divulsion, may appear probably from what we lately noted of the cohesion of pieces of marble and glass, and from some other phenomena, belonging to the *history of firmness*; from which we may properly enough borrow some instances, at least for illustration, in the doctrine of *fixedness*; in regard, that usually, though not always, the same things, that make a body firm, give it some degree of fixity, by keeping it from being dissipated by the wonted degrees of heat and agitation it meets with in the air. But to return to the contact we were speaking of, I think it not impossible (though you may perhaps think it strange) that the bare operation of the fire may, in some cases, procure a cohesion among the particles, (and consequently make them more fixed) as well as in others disjoin them, and thereby make them more volatile. For, as in some bodies the figures and sizes of the corpuscles may be such, that the action of the fire may rub or tear off the little beards, or hooks, or other particles, that intangle them, and so make them more easy for the corpuscles to be disengaged and fly upwards; so in other bodies the size and shape of the corpuscles may be such, that the agitation caused by the fire may rub them one against the other, so as by mutual attrition to grind, as it were, their surfaces, and make them so broad and smooth, if not also so flat, as that the contact of the corpuscles shall come to be made according to a large portion of their superficies: from whence will naturally follow a firm cohesion; which I shall illustrate by what we may observe among those, that grind glasses for telescopes and microscopes: for these artificers by long rubbing a piece of glass against a metaline dish or do by this attrition at length bring the two bodies to touch one another in so many parts of their congruous surfaces, that they will stick firmly to one another, so as sometimes to oblige the workmen to use violence to disjoin them. And this instance, (which is not the sole I could alledge) may suffice to shew, how a cohesion of corpuscles may be procured by the mutual adaptation of their congruous surfaces; and if two grosser corpuscles, or a greater number of smaller, be thus brought to stick together, you will easily believe their aggregate will prove too heavy or unwieldy for avolation. And to shew, that the fire may effect a levigation in the surface of some corpuscles, I have sometimes caused minium, and some other calces, that I judged convenient, to be

" melted for a competent time in a vehement fire conveniently administered ;
 " whereby, according to expectation, that, which was before a dull and incoherent
 " powder, was reduced into much grosser corpuscles, multitudes of whose grains
 " appeared smooth, glittering, and almost specular, like those of fine litharge of
 " gold ; and the masses, that these grains composed, were usually solid enough,
 " and of difficult fusion. And when I made glass of lead *per se* (which I elsewhere
 " teach you to do) it is plain, that the particles of the lead are reduced to a
 " great smoothness ; since, wheresoever you break the glass, the surfaces produced
 " at the crack will not be jagged, but smooth, and considerably specular : nor
 " do I think it impossible, that even when the fire doth not make any great
 " attrition of the corpuscles of the body to be fixed, it may occasion their stick-
 " ing together : because by long tumbling them up and down in various man-
 " ners, it may at length, after multitudes of revolutions and differing occurrences ;
 " bring those of their surfaces together, which, by reason of their breadth,
 " smoothness, or congruity of figure, are fit for mutual cohesion ; and when
 " once they come to stick, there is no necessity, that the same causes, that were
 " able to make them pass by one another, when their contact was but according
 " to an inconsiderable part of their surfaces, should have the same effect now
 " when their contact is full ; though, perhaps, if the degree of fire were much
 " increased, a more vehement agitation would surmount this cohesion, and dissi-
 " pate again these clusters of coalescent corpuscles.

" These conjectures will perhaps appear less extravagant, if you consider what
 " happens in the preparation of quick-silver precipitated *per se* : for there running
 " mercury, being put into a convenient shaped glass, is exposed to a moderate fire for
 " a considerable time (for I have sometimes found six or seven weeks to be too
 " short an one.) In this degree of fire the parts were variously tumbled, and
 " made many of them ascend, till convening into drops on the side of the glass,
 " their weight carries them down again ; but at length, after many mutual oc-
 " currences, if not also attritions, some of the parts begin to stick together in the
 " form of a red powder, and then more and more mercurial particles are fastened
 " to it, till at length all, or much the greatest part, of the mercury is reduced
 " into the like precipitate ; which, by the cohesion of the parts being grown more
 " fixed, will not with the same degree of heat be made to rise and circulate as
 " the mercury would before ; and yet, as I elsewhere note, I have found by trial,
 " that with a greater and competent degree of heat this precipitate *per se* would,
 " without the help of any volarizing additament, be easily reduced into running
 " mercury again. Chemists and physicians, who agree in supposing this precipi-
 " tate to be made without any additament, will, perchance, scarce be able to give
 " a more likely account of the consistency and degree of *fixity*, that is contained
 " in the mercury ; in which, since no body is added to it, there appears not to be
 " wrought any but a mechanical change. And though, I confess, I have not
 " been without suspicions, that, in philosophical strictness, this precipitate may
 " not be made *per se*, but that some penetrating igneous particles, especially saline,
 " may have associated themselves with the mercurial corpuscles ; yet, even upon
 " this supposition, it may be said, that these particles contribute to the effect, that
 " is produced, but by facilitating or procuring, by their opportune interposition,

" the mutual cohesion of corpuscles, that would not otherwise stick to one another.

" Perhaps it will not be altogether impertinent to add on this occasion, that for the generality of chemists, as well others as Helmontians, that assert the transmutation of all metals into gold by the philosophers stone, methinks, they may grant it to be probable, that a new and fit contexture of the parts of a volatile body may, especially by procuring a full contact among them, very much contribute to make them highly fixed. For, to omit what is related by less credible authors, it is averred upon his own trial by HELMONT, who pretended not to the elixir, that a grain of powder, that was given him, transmuted a pound (if I misremember not) of running mercury, where the proportion of the elixir to the mercury was so inconsiderable, that it cannot reasonably be supposed, that every corpuscle of the quick-silver, that before was volatile, was made extremely fixed merely by its coalition with a particle of the powder; since, to make one grain suffice for this coalition, the parts, it must be divided into, must be scarce conceivably minute; and therefore each single part not likely to be fixed itself; or, at least, more likely to be carried up by the vehemently agitated mercury, than to refrain that from avolation: Whereas, if we suppose the elixir to have made such a commutation among the corpuscles of the mercury, as (having made them somewhat perhaps change their figure, and expelled some inconvenient particles) to bring them to stick to one another, according to very great portions of their surfaces, and intangle one another, it will not be disagreeable to the mechanical doctrine of *fixity*, that the mercury should endure the fire, as well as gold, on the score of its new texture; which, supposing the story true, appears to have been introduced by the new colour, specific gravity, indissolubleness in aquafortis, and other qualities, wherein gold differs from mercury; especially malleableness, which, according to our notes about that quality, usually requires, that the parts, from whole union it results, be either hooked, branched, or otherwise adapted and fitted to make them take fast hold of one another, or stick close to one another. And since in the whole mass of the factitious gold, all save one grain, must be materially the same body, which, before the projection was made, was quick-silver, we may see, how great a proportion of volatile matter may, by an inconsiderable quantity of fixing additament, acquire such a new disposition of its parts, as to become most fixed. And, however, this instance will agree much better with the mechanical doctrine about *fixity*, than with that vulgar opinion of the chemists, wherewith it will not at all comply, that if in a mixture the volatile part do much exceed the fixed, it will carry up that, or at least a good portion thereof, with it; and on the contrary. But, though this rule holds in many cases, where there is no peculiar indisposition to the effect that is aimed at; yet, if the mechanical affections of the bodies be ill-suited to such a purpose, our philosophical experiment manifestly proves, that the rules will not hold, since so great a multitude of grains of mercury, instead of carrying up with them one grain of the elixir, are detained by it in the strongest fire. And thus much for the first way of fixing volatile bodies.

" The

" The second way of producing *fixity* is by expelling, breaking, or otherwise
 " disabling, those volatile corpuscles, that are too indisposed to be fixed them-
 " selves, or are fitted to carry up with them such particles, as would not without
 " their help ascend. That the expulsion of such parts is a proper means to make
 " the aggregate of those that remain more fixed, I presume, you will put me
 " seriously to prove; and we have a manifest instance of it in foot, where the
 " many active parts were, by the violence of the fire and current of the air, car-
 " ried up together by the more volatile parts: yet when foot is well distilled in a
 " retort, a competent time being given for the extricating and avolation of the
 " other parts, there will at the bottom remain a substance, that will not now
 " fly away, as it formerly did. And here let me observe, that the recesses of the
 " fugitive corpuscles may contribute to the fixation of a body, not barely be-
 " cause the remaining matter is freed from so many fixed, if not also volatilizing,
 " parts: but as it may often happen, that upon their recesses the parts or inter-
 " vals, they left behind them, are filled up with more solid or heavy matter;
 " and the body becomes, as more homogeneous, so more close and compact.
 " And whereas I intimated, that, besides the expulsion of unfit corpuscles, they
 " may be otherwise disabled from hindering the fixation of the mass they belong
 " to; I did it, because it seems very possible, that in some cases they may, by
 " the action of the fire, be so broken, as with their fragments to fill up the
 " pores or intervals of the body they appertained to, or may make such coal-
 " tions with the particles of a convenient additament, as to be no impediment to
 " the fixity of the whole mass, though they remain in it; which possibly you
 " may think may well happen, when you shall have perused the instances annexed
 " to the fourth way of fixing bodies.

" The third means of fixing or lessening the volatility of bodies is, by preserv-
 " ing that rest among the parts, whose contrary is necessary to their volatilisation.
 " And this may be done by preventing or checking that heat or other motion,
 " which external agents strive to introduce into the parts of the proposed body.
 " But this means tending rather to hinder the actual avolation of a portion of
 " matter, or at most procure a temporary abatement of its volatility, than to
 " give it a stable fixity, I shall not any longer insist on it.

" The fourth way of producing fixity in a body is by putting to it such an
 " appropriated additament, whether fixed or volatile, that the corpuscles of the
 " body may be put among themselves, or with those of the additament, into a
 " complicated state or intangled texture. This being the usual and principal
 " way of producing fixity, we shall dwell somewhat the longer upon it, and
 " give instances of several degrees of fixation: for, though they do not produce
 " that quality in the strictest acceptation of the word *fixity*, yet it is useful in
 " our present inquiry to take notice, by what means that volatility comes to be
 " gradually abated, since that may facilitate our understanding how the volatility
 " of a body comes to be *totally* abated, and consequently the body to be fixed.

" And first, we find, that a fixed additament, if its parts be conveniently
 " shaped, may easily give a degree of fixity to a very volatile body. Thus, " Spirit

“ spirit of nitre, that will of itself easily enough fly away in the air, having its saline particles associated with those of fixed nitre or salt of tartar, will with the alkali compose a salt of a nitrous nature, which will endure to be melted in a crucible, without being deprived even of its spirits. And I have found, that the spirits of nitre, that abound in aquafortis, being concoagulated with the silver, they corrode, though one would not expect, that such subtle corpuscles should stick fast to so compact and solid a body as silver; yet crystal, produced by their coalition, being put into a retort, may be kept a pretty while in fusion before the metal will let go the nitrous spirits. When we poured oil of vitriol upon the calx of vitriol, though many phlegmatic and other sulphureous particles were driven away by the excited heat, yet the saline parts, that combined with the fixed ones of the colcothar, stuck fast enough to them not to be easily driven away. And if oil of vitriol be, in a due proportion, dropt upon salt of tartar, there results a tartarum vitriolatum, wherein the acid and alkalize parts cohere so strongly, that it is not an ordinary degree of fire will be able to disjoin them: inasmuch that divers chemists have (though very erroneously) thought this compounded salt to be indestructible. But a less heavy liquor than the ponderous oil of vitriol, may by an alkali be more strongly detained than that oil itself; experience having assured me, that spirit of salt being dropt to satiety upon a fixed alkali, (I used either that of nitre or of tartar) there would be made so strict an union, that having distilled the resulting salt with a strong and lasting fire, it appeared not at all considerably to be wrought upon, and was not so much as melted.

“ But it is not the bare mixture or commision of volatile particles with fixed ones (yea though the former be predominant in quantity) that will suffice to elevate the latter. For, unless the figures of the latter be congruous and fitted to fasten to the other, the volatile parts will fly away in the heat, and leave the rest as fixed as before; as when sand or ashes being wetted, or drenched with water, they quickly part with that water, without parting with any degree of their fixity: but on the other side, it is not always necessary, that the body, which is fitted to destroy, or much abate, the volatility of another substance, should be itself fixed. For, if there be a skilful or lucky coaptation of the figures of the particles of both the bodies, these particles may take such hold of one another, as to compose corpuscles, that will neither, by reason of their strict union, be divided by heat, nor by reason of their resulting grossness be elevated even by a strong fire, or at least by such a degree of heat, as would have sufficed to raise more indisposed bodies than either of the separate ingredients of mixture. This observation, if duly made out, does so much favour our doctrine, about the mechanical origin of *fixation*, and may be of such use, not only to chemists, in some of their operations, but to philosophers, in assigning the causes of divers phenomena of nature, that it may be worth while to exemplify it by some instances.

“ The first whereof I shall take from an usual practice of the chemists themselves, which I the rather do, to let you see, that such known experiments are too often overlooked by them that make them; but yet may hint or confirm theories

theories to those that reflect on them. The instance I here speak of, is that which is afforded by the vulgar preparation of bezoardicum minerale. For, tho' the rectified butter or oil of antimony, and the spirit of nitre, that are put together to make this white precipitate, are both of them distilled liquors; yet the copious powder, that results from their union, is, by that union of volatile parts, so far fixed, that after they haveedulcorated it with water, they prescribe the calcining of it in a crucible for five or six hours; which operation it could not bear, unless it had attained to a considerable fixation. This discourse supposes, with the generality of chemists, that the addition of a due quantity of spirit of nitre is necessary to be employed in making the bezoardicum minerale; but, if it be a true observation, which is attributed to the learned GUNTHERUS BILLICHIVS (but which I had no furnace at hand to examine when I heard of it) if, I say, it be true, that a bezoardicum minerale may be obtained without spirit of nitre, barely by a slow evaporation, made in a glass-dish, of the more fugitive parts of the oil of antimony; this instance will not indeed be proper in this place, but yet will belong to the second of the foregoing ways of introducing fixity. I proceed now to alledge other particulars in favour of the above-mentioned observation. If you take strong spirit of salt, that when the glass is unstopt would smoak of itself in the cold air, and satiate it with the volatile spirit of urine; the superfluous moisture being abstracted, you will obtain by this preparation (which, you may remember, I long since communicated to you, and divers others virtuosi) a compounded salt, scarce, if at all, distinguishable from sal armoniac, and which will not, as the salt it consists of will do, before their coalition, easily fly up of itself into the air, but will require a not despicable degree of fire to sublime it. Of these semivolatile compositions of salt I have made, and elsewhere mentioned, others, which I shall not here repeat, but pass on to other instances pertinent to our present design. I lately mentioned, that the volatility of the spirits of nitre may be very much abated by bringing them to coagulate into crystals with particles of corroded silver; but I shall now add, that I guessed, and by trial found, that these nitrous spirits may be made much more fixed by addition of the spirit of salt; which, if it be good, will of itself smoke in the air. For having dissolved a convenient quantity of crystals of silver in distilled water, and precipitated them, not with a solution of salt, but the spirit of salt, the phlegm being abstracted, and some few of the looser saline particles, though the remaining mass were pressed with a violent fire, that kept the retort red-hot for a good while; yet the nitrous and saline spirits would by no means be driven away from the silver, but continued in fusion with it; and when the mass was taken out, these spirits did so abound in it, that it had no appearance of a metal, but looked rather like a thick piece of horn.

The next instance I shall name, is afforded us by that kind of turbit, which may be made by oil of vitriol, instead of the aquaortis employed in the common turbitum minerale. For, though oil of vitriol be a distilled liquor, and mercury a body volatile enough, yet when we abstracted four or five parts of oil of vitriol from one of quick-silver, (especially if the operation were repeated) and then washed off as much as we could of the saline particle of the oil of vitriol;

“ yet

" yet those that remained, adhering to the mercury, made it far more fixed than
 " either of the liquors had been before, and enabled it, even in a crucible, to
 " endure such a degree of fire, before it could be driven away, as I confess I
 " somewhat wondered at. The like turbith may be made with oil of sulphur per
 " campanam. But this is nothing to what HELMONT tells us of the operation of
 " his alkali, where he affirms, that that menstruum, which is volatile enough,
 " being abstracted from running mercury, not only conglutates it, but leaves it
 " fixed so, that it will endure the brunt of fires actuated by bellows, (*omnem sol-*
 " *lium ignem.*) If this be certain, it will not be a slender proof, that fixity may
 " be mechanically produced; and however, the argument will be good in reference
 " to the Helmontian Spagyrics: for if, as one would expect, there do remain
 " some particles of the menstruum with those of the metal, it will not be denied,
 " that two volatile substances may perfectly fix one another. And if, as HELMONT
 " seems to think, the menstruum be totally abstracted, this supposition will the more
 " favour the doctrine about fixity; since, if there be no material additament left
 " with the quick-silver, the fixation cannot reasonably be ascribed to any thing,
 " as to some new mechanical modification, and particularly to some change of
 " texture, introduced into the mercury itself.

" And that you may think this the less improbable, I will now proceed to some
 " instances, whereof the first shall be this, that having put a mixture, made of
 " two dry, as well as volatile bodies (usually enough employed by spagyrics) to
 " half its weight of common running mercury, and elevated its mixture three
 " or four times from it, the mercury, that lay in the bottom, in the form of a pon-
 " derous and somewhat purplish powder, was by this operation so fixed, that it
 " long endured a strong fire, which at length was made so strong, that it melted
 " the glass, and kept it melted, without being strong enough to force out the
 " mercury; which, by some trials, not so proper to be here mentioned, seemed
 " to have its salivating and emetic powers extraordinarily infringed. But this
 " only upon the by: in all the other instances (wherewith I shall conclude these
 " notes) I shall employ one menstruum, oil of vitriol, and shew you the efficacy
 " of it, in fixing some parts of volatile bodies with some parts of itself; by which
 " examples it may appear, that a volatile body may not only lessen the volati-
 " lity of another body, (as in the lately mentioned case of our spirituous salarmo-
 " niac) but that two substances, that apart were volatile, may compose a third,
 " that will not only be less volatile, but considerably (if not altogether) fixt.

" We mixed then by degrees about equal parts of oil of vitriol and oil of tur-
 " pentine; and though each of them single, especially the latter, will ascend
 " with a moderate fire in a sand furnace, yet after the distillation was ended, we
 " had a considerable quantity, sometimes (if I misremember not) a fifth or sixth
 " part, of a caput mortuum, black as a coal, and whereof a great part was of a
 " scarce to be expected fixedness in the fire.

" To give a higher proof of the disposition, that oil of vitriol has, to let some
 " of its parts grow fixed by combination with those of an exceeding volatile ad-
 " ditament, I mixed this liquor with an equal or double weight of highly recti-
 " fied

“fied spirit of wine, and not only after, but sometimes without, previous digestion, I found, that the fluid parts of the mixture being totally abstracted, there would remain a pretty quantity of a black substance so fixed, as to afford just cause of wonder.

“And because camphire is esteemed the most fugitive of consistent bodies, in regard that, being but laid in the free air, without any help of the fire, it will fly all away; I tried, what oil of vitriol, abstracted from camphire, would do, and found at the bottom of the retort a greater quantity, than one would expect, of a substance as black as pitch, and almost as far from the volatility as from the colour of camphire; though it appeared not, that any of the gum had sublimed into the neck of the retort.

“From all which instances it seems manifestly enough to follow, that in many cases there need nothing to make associated particles, whether volatile or not, become fixed, but either to implicate or intangle them among themselves; or bring them to touch one another, according to large portions of their surfaces; or by both these ways conjointly, or by some others, to procure the firm cohesion of so many particles, that the resulting corpuscles be too big or heavy, to be by the degree of fire, wherein they are said to be fixed, driven up into the air.”

It was proposed, as convenient, that seeing it was not to be expected, that the members would presently, upon hearing of such discourses as these give their thoughts of them, it would be proper to do it at the next meeting, after the reading of another lecture.

A committee was appointed for auditing the treasurer's accounts, consisting of Mr. AERSKINE, Dr. WHISTLER, Dr. SMITH, Mr. HOOKE, and Mr. COLLINS.

Mr. OLDENBURG read a letter to himself from Dr. SWAMMERDAM, dated at Amsterdam, 9th October, 1674^b, containing a description and draught of a rupture of a mesentery, a rare case.

Mr. HENSHAW presented the Society with several curiosities, which he had brought with him out of Denmark: viz.

1. A great piece of fossil amber, found in the fortifying of Ransburg in Holstein, above six English yards under the earth, the place being twenty-five English miles from the Baltic, and above thirty-six English miles from the German sea; which sea also does not flow within twenty-one English miles of that town, as was attested by a letter written 7th December, 1672, by Mr. ODMAN, an eye-witness of the taking up of this amber.

^b Letter-book, vol. vii. p. 108. It is printed in the Philof. Transact. vol. x. n° 112. p. 273. for March, 1675.

2. An *Alga Saccharifera*, of which OLAUS BORRICHIVS by his own hand writes thus: "*Alga Saccharifera nascitur in mari Islandico non procul a litore, ejiciturque in litus, per tempestates, ubi simul ac emerferit e mari, falsedinem lingue offert. Sed ubi aliquandiu in litore recubuit, sensim salus ille sapor illi ab aqua marina perit, ejusque loco pederentim operitur alba quadam veluti farina, quæ Saccharum dulcedine & colore imitatur, usurpaturque incolis Sacchari loco. Mihi allata quæ fuit ex Islandia, sapore & farina illa adventitia diu carebat; sed tandem in fenestra aliquandiu quasi neglecta jaccens eodem modo farina Saccharina cooperta fuit, maxime inferiori.*"

3. *Scarabeus Islandicus*, qui adhaeret, teste eodem BORRICHIO, certo generi *Asellorum piscium in mari Islandico, quod genus Asellorum Danis appellatur* KUTLER. One of these being opened, it was found filled up with a gummos reddish substance, some part transparent, into which all the inner parts of this insect seemed to have been converted.

4. A black substance, which seemed to be wood turned into jett, dug out of the ground in Denmark.

5. A piece of Iceland crystal (as it is vulgarly called) having a double refraction.

6. Some figured Icelandic stones.

7. Some pieces of silver, said to be dug out of the mines of Norway.

8. Some white amber.

Mr. HIENSHAW shewed also a very fine horn of a young horn-fish, not hollow; as likewise three pieces of fine amber, two whereof had insects inclosed in them, the third a moveable bubble, which, he said, would in a frost congeal and become immoveable, and upon a thaw, or being put in a warm place, become moveable again.

Mr. OLDENBURG presented to the Society three books: 1. Dr. WALLIS's *Grammatica Linguae Anglicanae* augmented. 2. ERASMI BARTHOLINI *selecta Geometrica*: printed at Copenhagen in 1674, in 4to. 3. DAVIDIS VONDER BECK, *Mindani, Experimenta & Meditationes circa Naturalium Rerum principia*: printed at Hamburg, 1674, in 8vo, and dedicated to the Royal Society.

November 23. At a meeting of the COUNCIL were present

The lord viscount BOUNCKER, president,	Mr. COLWALL,
The lord bishop of Salisbury,	Mr. HOSKYNs,
Sir JOHN LOWTHER,	Mr. HILL,
Sir WILLIAM PETTY,	Mr. OLDENBURG.
Dr. GODDARD,	

It was ordered, that the declaration, with the form of the new bond annexed to it, be put to the presb, so that a proof of it might be ready for the next meeting of the council: and

That Mr. BARLOW be taken for collector of the arrears, after he had given a bond of his own of one hundred pounds for security, and that he be allowed twelve pence in the pound: and that this be declared to him by the president, in the name of the council: which was done accordingly.

The members of the council, who were present, sealed the new bond.

Mr. HOOKS being called upon to make a report of the view, which he had been desired to make, of the houses and lands in Hog Lane, proposed by Sir WILLIAM PETTY for employing the four hundred pounds legacy; and he not having yet taken that view, was desired again to do it against the next meeting of the council.

Memorandum. That those, who were at the council, subscribed the new obligation for paying fifty two shillings a-year, but with this reserve, that in case the number of the subscribers should not amount to fifty, between that time and Lady day following, those, who had actually subscribed, should be free from the said obligation.

November 26. At a meeting of the council were present

The lord viscount Brouncker, president,	
The lord bishop of Salisbury.	Mr. COLWALL,
Sir JOHN LOWTHER,	Mr. HOSKYNs,
Sir WILLIAM PETTY,	Mr. HILL,
Sir ROBERT SOUTHWELL,	Mr. OLDENBURG.
Dr. GODDARD,	

The committee of the council for auditing the accounts made their report, which was approved of.

Mr. HOOKE gave the council some account of the houses and lands in Hog Lane, proposed by Sir WILLIAM PETTY, the consideration whereof was referred to another meeting.

A proof of the declaration being ready, it was read again, and after some alterations ordered to be printed off, to the number of two hundred and twenty-five copies, to be committed to the custody of the president.

At a meeting of the SOCIETY on the same day,

Mr. HENRY JENKES, professor of rhetoric at Gresham College, was proposed candidate by Mr. HILL.

Sir WILLIAM PETTY presented to the Society his discourse concerning the importance and usefulness to human life of the consideration of duplicate and sub-duplicate proportion: which discourse was read and ordered to be registered³, and printed⁴.

This discourse was made out by the following instances, viz.

1. In the drawing or driving powers, which force ships or other bodies through the water, with reference to the respective velocities caused thereby.
2. In the shapes or sharpness of bodies, cutting or dividing the water, through which they are driven or drawn, and in the different velocities arising from thence, where the bodies and forces are equal.
3. In the strength of timbers, or other heterogeneous materials applied to buildings, to carts, or to any other machinaments intended for strength; and how by a model to judge of the sufficiency of such engine as is represented by it.
4. In the effect of oars upon equal and alike vessels, according to their numbers, length, blades, and motions with or against the stream or on even waters.
5. In the motion or travelling of horses on their several paces, and with different burthens on them.
6. In the strength and velocity of mills and their wheels.
7. In the effects of gun-powder.
8. In the distances at which sounds may be heard.
9. In the distances at which odoriferous matters may be smelt.
10. In the distances at which the objects of sight may be seen.
11. In the time of the returns made by vibrating pendulums.
12. In the lives of men and their duration.
13. In musical and sounding bodies, such as strings and bells.
14. In the effects and motions of fire and burning spirits.
15. In the rising and falling of bodies, but especially of water in pumps, over-shot mills, leaks in ships, the heights of rivers at their head above their fall into the sea.
16. In bellows.

³ Register, vol. iv. p. 246.

⁴ It was printed at London, 1674, in 12°. A censure of it is published in the *Genuine Reasoner*

of Dr. THOMAS BARLOW, bishop of Lincoln, p. 151. Edit. London, 1693, in 2vo.

17. In the prices of several commodities, as masts, diamonds, large timber, amber, load-stones, &c.

18. In mill-dams, sea-brooks, and the bulwarks or walls of fortresses.

19. In the compression of wool, and other elastic bodies, and of the air within diving vessels; as also in the effects of screw-presses upon several materials.

The appendix contains a new hypothesis of springing or elastic motions.

It was ordered, that an apparatus be made for trying experiments about springiness.

November 30. Mr. JENKES was elected.

Sir JONAS MOORE was proposed candidate by the president.

The committee of the Society for auditing the accounts made their report, as follows:

" The committee of the Royal Society for auditing the treasurer's accounts, November 26, 1674,

" We find Mr. DANIEL COLWALL debtor,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
" To monies he hath received on the several quarterly payments of {			
" the Society from 13 Novemb. 1673, to 19 Novemb. 1674, }	190	6	6
" To monies he hath received for admissions - - - - -	15	3	0
" To balance of his account of November 13th, 1673, - - - - -	5	12	1
" To money more by a legacy of the late lord bishop of Chester	400	0	0
	£609	1	7

" We also find he is creditor,

" By monies he hath paid for the use of the Society by order	183	5	0
" By balance resting in cash in his hands - - - - -	25	16	5
" And by money paid into the cash chest of the Society - - - - -	400	0	0
	£609	1	7

This done, the Society, at which forty-two members were present, proceeded to the election of a new council and officers.

Of the old council were continued

The lord viscount BRONCKER,
The earl marshal,

The lord bishop of Salisbury,
Sir JOHN LOWTHER,

Sir

Sir WILLIAM PETTY,
 Sir ROBERT SOUTHWELL,
 Dr. GODDARD,
 Mr. COLWALL,

Mr. HOSKYNs,
 Mr. HILL,
 Mr. OLDENBURG.

The ten new members of the council were

The earl of Aylesbury,
 Sir JOSEPH WILLIAMSON,
 Sir JAMES SHAEN,
 Sir JOHN LAURENCE,
 Sir JOHN BANKES,

Mr. HENSHAW,
 Mr. PEPYS,
 Dr. WHISTLER,
 Mr. SMITH,
 Dr. DANIEL COX.

The officers elected were

The lord viscount Brouncker, president,
 Mr. COLWALL, treasurer,
 Mr. HILL,
 Mr. OLDENBURG, } secretaries.

Of the ten new members of the council were sworn these three only, Sir JAMES SHAEN, Mr. PEPYS, and Dr. WHISTLER; the rest being absent.

December 3. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
The lord bishop of Salisbury,	Dr. GODDARD,
Sir JOHN LOWTHER,	Dr. WHISTLER,
Sir WILLIAM PETTY,	Mr. COLWALL,
Sir ROBERT SOUTHWELL,	Mr. OLDENBURG,

It was resolved, that every member of the present council shall provide an experimental discourse for the Society to be made at some one public meeting within the year, either by himself or by some other member of the Society; or to pay forty shillings.

It was ordered, that Mr. OLDENBURG be desired to offer the new legal obligation for paying fifty-two shillings a year for the use of the Royal Society, to as many members of the same to sign and seal, as conveniently he can; and likewise shew them the statute made by the council to engage every fellow of the Society to such a subscription:

That there be forthwith made a catalogue of all the presents made by several persons to the Society; together with the names of the donors; and that duplicates thereof be made, the one to be kept by the keeper of the repository, and the other by the treasurer *pro tempore*:

That a catalogue be made of all the instruments or other apparatus of the Society, paid for out of the public treasury; and that the instruments be looked out and kept together in the repository for instruments:

That a table and catalogue be made of all the books, discourses, letters, and accounts, brought into the Society; together with the names of the authors: and that all the said books, discourses, letters, and accounts, be kept in convenient presses under locks and keys, and that the president and secretaries *pro tempore* have the keeping of the said keys: And,

That Mr. AUBREY and Mr. COLLINS be desired to be assisting in this business, and to make proposals at the next meeting of the council on that day se'nnight, what they would expect for their assistance.

Memorandum, that it was propounded by Sir WILLIAM PETTY, that all the discourses entered into the Society's Register-books should be divided into several sections and chapters; and that this should be taken into consideration at the next meeting of the council.

At a meeting of the SOCIETY on the same day

Sir JONAS MOORE was elected and admitted.

Sir PAUL WHICHEOTE, Bart. was proposed candidate by Dr. BROWN.

Mr. HOOKE read his discourse concerning the construction and uses of his new quadrant for making remote observations with great exactness.

He was desired to have this instrument perfected; and for trying the performance of it, the lord bishop of Salisbury, Sir WILLIAM PETTY, Sir CHRISTOPHER WREN, and Sir JONAS MOORE, were desired to meet as a committee on the Tuesday following in the afternoon for that purpose.

MONS. LEYENBERGH, envoy extraordinary from the king of Sweden, sent a paper containing a list of some pretended new mechanical and geographical inventions by one ANDREW ALEXANDER, a German, viz.

1. *Anemometrum, b. e. instrumentum ad vires venti quovis tempore terra marique metiendas.*

2. *Machina transportatrix universalis ad res graves particulatim facili opera & continuatione sursum vel deorsum, vel etiam via horizontali transferendas; cujus usus potissimum architectura civili et militari nemque ad machinas hydraulicas.*

3. *Structura caminerum noviter inventa, qui optime sumum trahant, itemque correctio caminorum fumantium.*

4: *Supple-*

4. *Supplementum geographicum ad usum mapparum longe expeditiorem; res quidem magni laboris, sed amplissima perpetuæque utilitatis, hactenus a nemine tentata.*

5. *Cogitata super præcipuo rei nauticæ problemate de inveniendis per mare longitudinibus sive meridianis, sub quibus navis versetur.*

Sir JOSEPH WILLIAMSON, who said he knew this person, and Sir WILLIAM PETTY were desired, at their conveniency, to examine him about these particulars.

Sir JOHN LAWRENCE, Sir JOHN BANKES, and Mr. HENSHAW, were sworn as members of the council.

December 10. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
The lord bishop of Sarum,	Mr. COLWALL,
Sir WILLIAM PETTY,	Mr. HILL,
Mr. HENSHAW,	Mr. OLDENBURG.
Dr. GODDARD,	

It was ordered, that the Society having desired Sir WILLIAM PETTY to print his discourse made before them on the 26th of November last, it be printed by the printer to the Society.

The council having formerly charged themselves to provide each of them an experimental discourse for the Society at some one meeting within the year, it was resolved, that a letter should be written by the secretary, and signed by the president, to the fellows of the Society hereafter named, to desire them to provide the like discourses, and to name the day after the 14th of January next, when to bring them in.

The said fellows were

Sir CHRISTOPHER WREN,	Dr. SMITH,
Mr. EVELYN,	Dr. VOSSIUS,
Dr. HOLDER,	Mr. WYLDE,
Dr. CROUNE,	Mr. BERNARD,
Dr. WALTER NEEDHAM,	Dr. KING,
Dr. BROWN,	Mr. COLLINS.
Dr. POPE,	

The council nominated also those persons, to whom application should be made for signing the new bond, viz.

The earl of Anglesey,	The earl of Shaftesbury,
The earl of Strafford,	The lord bishop of Chester,
The earl of Devonshire,	The lord BRERETON,

Sir

Sir CHARLES BERKLEY,
 Sir KINGSMILL LUCY,
 Sir GILBERT TALBOT,
 Mr. THOMAS HOWARD,
 Mr. JOHN STAFFORD HOWARD,
 Mr. JOHN WILLIAMS,
 Dr. TILLOTSON,
 Mr. BARRINGTON,

Mr. SLINGESBY,
 Mr. NEILE,
 Dr. GLISSON,
 Dr. THOMAS COX,
 Mr. THOMAS COX,
 Mr. LOCKE,
 Mr. PACKER,
 Mr. WYLDE.

At a meeting of the SOCIETY on the same day,

DANIEL MILLER, B. D. was proposed candidate by the president.

Dr. GREW presented and read his *discourse concerning the nature, causes, and power of mixture*; which was ordered to be registered*.

Several of the experiments mentioned in this discourse were exhibited after it was read.

December 17. At a meeting of the COUNCIL were present

The lord viscount BROWCKER, president,	
The lord bishop of Salisbury,	Mr. PEPYS,
Sir JOHN LOWTHER,	Dr. GODDARD,
Sir JAMES SHAEN,	Dr. WHISTLER,
Sir JOAN BANKES,	Mr. COLWALL,
Sir WILLIAM PETTY,	Mr. OLDENBURG.
Mr. HENSHAW,	

Dr. COX having promised to entertain the Society on the 7th of January, Mr. HOOKE undertook to do the like on the 14th of that month.

Sir JOHN LOWTHER, Sir JOHN BANKES, Mr. PEPYS, and Dr. GODDARD, were appointed a committee to consider, whether the four hundred pounds legacy might not be best laid out upon fee-farm rents: and they were desired to ripen this business for the 17th of January, and make their report to the council.

The president, Sir ROBERT SOUTHWELL, and Mr. PEPYS, were desired to make application to his highness prince RUPERT, concerning the mischief, which his glais-house does to Chelsea-college; and to suggest to the prince, that his highness may perhaps put it and the land to some good uses, if he pleases to take it to himself, and to consider the Society for it.

It was resolved, that Sir JONAS MOORE be desired to write a letter to the prince, and to acquaint him, that the house and land of Chelsea might have been well

* Register-book, vol. iv. p. 271. It is printed in his *Anatomy of Plants*, b. iv. London, 1682, in folio.

disposed of for the benefit of the Society, if it had not been for the annoyance of the neighbouring glass-house.

The form of the letter drawn up by Mr. OLDENBURG to be written to divers members of the Society, to desire them to provide discourses for the public meetings, was reported by Mr. OLDENBURG to have been viewed and altered by the president, and by his lordship ordered to be thus issued :

“ Sir,

“ The council of the Royal Society considering with themselves the great importance of having the public meetings of the said Society constantly provided with entertainments suitable to the design of their institution, have thought fit to undertake to contribute each of them one; not doubting but that many of the fellows of the Society will join with them in carrying on such an undertaking. And well persuaded of your approbation of this their purpose, so much tending to the reputation and support of the Society, they desire, that you would be pleased to undertake for one, and to name any Thursday after the 14th of January next, such as shall be most convenient for you, when you will present the Society at one of their said public meetings by yourself, or some other of the fellows for you, with such a discourse, grounded upon or leading to philosophical experiments, on a subject of your own choice. In doing of which you will benefit the Society, and oblige,

“ Sir,

“ Your humble servant,

“ Brouncker, P. R. S.”

Mr. Hooke having proposed to the council, that in order to the bringing in of several sets of experiments, that would require an apparatus of instruments for the making of them, such instruments might be ordered to be prepared, whilst he was drawing up such experiments; the council resolved, that the sets of experiments should be first brought in before them; and that then they would consider of and give order for such instruments, as should be necessary for exhibiting the same.

The council farther desiring Mr. Hooke to name a set of experiments to begin with, he named those of the magnet.

At a meeting of the SOCIETY on the same day,

Mr. RAY's two discourses, one on *the seeds of plants*, and another on *the specific differences of plants*, were presented from him by Mr. OLDENBURG; and read, and ordered to be registered¹; and were as follows :

“ A discourse on the seeds of plants.

“ Nature observes not proportion of magnitude between seeds and the plants,

¹ Register, vol. iv. p. 286, and 294.

“ that

“ that come of them ; I mean so, as that the greater seed should produce the
 “ greater plant, and the lesser seed the lesser plant : for the seeds of several trees
 “ are much less than the seeds of many herbs : as for example, the seeds of elm,
 “ poplar, willow, birch, alder, than the seeds of beans, pease, lupines, and all
 “ kinds of pulse, pumpions, melons, and all kind of pomiferous herbs, not to
 “ mention infinite others. This holds true, not only in plants of different kinds,
 “ but even in those of the same, as I have observed in oaks ; the scarlet oak,
 “ which seldom rises higher than a small shrub, bearing an acorn as big as our
 “ English oak : and in honey-wort, the purple annual kind bearing a seed twice
 “ as big as the great perennial mountain kind. The like difference may be ob-
 “ served between the seeds of mustard and charlock, several sorts of lotus, and
 “ many others.

“ Neither indeed in oviparous animals doth nature always observe the same
 “ proportion of magnitude between the eggs, that is, between the animals, al-
 “ though of the same tribe or genus : for, though lobsters or crayfish be so like
 “ one to the other, that one can find little difference between them, save only in
 “ magnitude ; yet are the eggs of the crayfish, which is the lesser, bigger than
 “ those of the lobster, which is the greater : and, in whole-footed birds, the eggs
 “ of the duffin, auk, and guillemot (which lay but one egg at a time) are as
 “ much bigger than ducks eggs, as the birds themselves are less than ducks.

“ Though in some plants, which run much by the root or wire, or that pro-
 “ pagate themselves by off-sets, it be true, which some have observed, that they
 “ seldom bring their seed to maturity, as if nature, intent upon those ways of pro-
 “ pagation, did neglect that by the seed : such plants are colocasia, horse-radish,
 “ periwinkle, Jerusalem-artichoke ; though, I say, this held true in some, yet
 “ is it far from a general rule ; there being many plants, which abundantly pro-
 “ pagate themselves by the root or wire, and yet yield plentiful ripe seed too,
 “ as goutwort, mint, strawberry, &c. But on the other side, I think, it may
 “ pass for a general truth, that plants, which bring little seed to maturity, do
 “ abundantly spread or multiply themselves some other ways ; else nature might
 “ seem to be wanting in means for the conservation of such species.

“ The lesser seeds are the most fertile, such plants as bear the least seed bringing
 “ the greatest plenty or abundance : as, for example, tobacco, which, for a plant
 “ of that bigness, bears the least seed of any I know, producing the greatest
 “ number of seeds ; LAUREMBERGIUS counting from one plant an increase of
 “ three hundred and sixty thousand.

“ Among the seeds of herbs I have observed, that the greatest of all are such
 “ as come of annual plants, to wit, beans, pease, lupines, maize, or Turkey-
 “ wheat, &c. In these kinds (of pulse and grasses) the annual (though sometimes
 “ less plants) have greater seeds than the perennials ; as for instance, the com-
 “ mon pease than the everlasting pease ; but always, I think, it happens so in
 “ these kinds, if the plants be of equal bigness, that the seeds of the annual
 “ are larger than the seeds of the perennial.

" It is worth the noting, that all those seeds, that are used by mankind for food, are seeds of annual plants, viz. wheat, rye, spelt, maize, rice, barley, oats, millet, panic, forghum; and of pulse, beans, peas, lupines, kidney-beans, vetches, lentils: the reason whereof, I suppose, is no other, than because they are in their kinds the greater, and have the more pulp. For I doubt not but many perennial grasses bear esculent seed, as well as these annual ones, which we call corns; and I believe some perennial pulse too, though none so large as these annual ones we use.

" The greatest number of plants, that come of seed, spring at first out of the earth with two leaves, which being for the most part of a different figure from the succeeding leaves, are by our gardeners not improperly called the seed-leaves.

" These seed-leaves are for the most part entire or undivided, even in those plants, whose after-leaves are most finely or minutely dissected, as in the umbelliferous kind. For the most part, I say, for in some few they are indented; as in radish with one indenture, in Indian-cress with two. In garden-cress each seed leaf is divided into three segments.

" The seed-leaves are for the most part smooth, even in those, whose after-leaves are rough or hairy. In some few, as for example, the Roman nettle, and I believe all other nettles, the seed-leaves also are rough.

" In all those plants, which spring up with two-seed leaves, the whole pulp or content of the seed is nothing else but the young plant perfectly formed, mature, and ready for exclusion: so that, if you carefully take off the teguments of the seed, either while yet green, or well steeped when ripe, you may clearly see and distinguish all the parts of the included plant, viz. the radicle or germen of the root, and two seed-leaves in all, and in some the rudiment of the stem and plant-leaves besides, as in the common bean and kidney-bean: in this last, the two first plant-leaves being perfectly formed.

" In the seeds of these plants, when mature, I could never observe any cohesion between the teguments and the included plant.

" Those seeds, whose pulp is nothing else but the included plant, are of two sorts. 1. In some the two seed-leaves lie plain, smooth, and extended, without plait or fold. 2. In others, the two seed-leaves, together with the radicle, are variously folded up.

" In the first kind, the seed-leaves are nothing but the two lobes of the seed having their plain sides clapt together, like the two halves of a walnut; and therefore are of the just figure of the seed, slit in sunder flat-wise, as in pumpkin and melon seeds, and many others.

" In

" In these, though the whole pulp seems to be compounded of two lobes, yet
 " to him, that carefully views and examines it, the radicle also will easily appear,
 " inserted into each lobe, and connecting both together like a couple or hinge.

" This union of the radicle to the lobes is either, first, at that end of the seed,
 " which coheres to the fruit or seed-vessel, as in apple and pear kernels, sun-flower
 " seed, melon and pumpkin seed, and abundance more: or, 2dly, At a distance
 " from the place of cohesion, as in beans, lupines, and all sorts of pulse, &c.
 " or, 3dly, At the quite contrary ends, as in borage, bugloss, and others of that
 " family.

" In such, whose radicle is at either extreme, I have observed it to be at the
 " sharper or more pointed one; so that if the sharper end of the seed be that, which
 " coheres to the seed-vessels, the radicle is always at that end, as in apple or pear
 " kernels, and the rest before instanced in: but if the sharper extreme be the
 " tip of the seed, or the end just opposite to the place of cohesion, the radicle
 " shall be at that end, as in acorns, almonds, &c. In both these kinds, the ra-
 " dicle must needs be short.

" In such seeds, wherein the connexion of the lobes is at a distance from the
 " place of cohesion, but not at the just opposite part or end, the radicle is longer
 " than in the two former kinds, and runs bending along the verge of the lobes,
 " till the the tip of it comes to point at the place of cohesion.

" This observation may be of some advantage in setting, at least the larger sort
 " of seeds; for it will certainly somewhat promote the springing of the seeds, so
 " to set them, that the point of the radicle may be downwards, or at least so as
 " they naturally lie, when fallen from their plants upon maturity. And it must
 " needs hinder their growth, to set the point of the radicle just upwards, the ra-
 " dicle in such a case being forced to bend two right angles, or a whole semicircle,
 " before it come to run directly down again; and likewise, on the contrary side,
 " the stem to turn as much before it can mount up; so that the sap will have a
 " double reflection before it get out of the root into the stalk.

" In the second kind, that is those seeds, wherein the seed-leaves and radicle lie
 " folded up, the pulp of the seed cannot properly be said to be divided into two
 " lobes.

" In these the complication of the leaves and radicle is very different. In the
 " radish, turnep, and, I believe, all that come up with such a fashioned leaf, the
 " young plant is most elegantly folded up into a globular figure, viz. the seed-
 " leaves being clapt together, as in all others, first the radicle is turned up upon
 " them; then the two sides of the seed-leaves are turned over the radicle, one
 " one way, the other the contrary, so embracing it. In the seed of the syc-
 " more-tree, the two seed-leaves clapt together as before are first bent backwards
 " upon themselves, and then with the radicle rolled up into a round roll, as if
 " one should double a short and narrow ribband or thong of leather twice, and
 " then

“ then roll it up. In the garden cress, the two lateral segments of each seed-leaf being laid close on the back of the main, or end segment (as being together of the just breadth of it) the said end segments clapt together are so inclosed in the teguments; the radicle being not turned up immediately upon the seed-leaves, but as it were first lying at length involved in the teguments, and so turned up upon the seed-leaves; as if one should double or bend the seed together after it was inclosed in its coats; as may be evidently seen by any one, that will but take the pains carefully to view and heed the seed. The like bending or doubling together of the seed I have observed in *dames violet*. Besides these, many other different ways there are of making up seeds in their teguments, which it would be tedious to describe, and difficult to understand, unless illustrated by figures: only I cannot but take notice, that though the maple be a congenerous tree to the sycamore, yet is the young plant in the seed differently folded up from that of the sycamore in its seed.

“ Of seeds, that spring out of the earth with leaves like the *succeeding*, and no seed-leaves, I have observed two sorts. 1. Such as are congenerous to the first kind precedent; that is, whose pulp is divided into two lobes and a radicle. The only difference between them is, that these bring not up their lobes above ground in form of leaves, as the other do, though I doubt not but the lobes of the seed have the same use in these as in those that bring them up. For in the same family of plants, some seeds bring up their lobes above ground, others do not, as in the legumina or pulse kind, the common bean brings them not up, the kidney-bean doth; the pease again doth not, the lupine doth.

“ 2. Such, which neither spring out of the ground with seed-leaves, nor have their pulp divided into lobes; of these I have observed two kinds. 1. Such, in which the included plane is but a small part of the pulp of the seed; (in those I have hitherto observed I think scarce a tenth.) 2. Such, in which the whole pulp is nothing else but the included plant. Of the first kind I have observed two sorts: 1. Such, in which the young plant sticks to that end of the seed, which grows to the seed vessel or mother-plant, in form almost of a bud, together with its scutcheon, clapt to the body or branch of a tree in inoculation. 2. Such, in which the embryo-plant is inclosed in the middle of the seed, as it were a pith or kernel.

“ Of the first sort are all corns; I mean cerealia, as contradistinct to legumina, and grasses. All these have fibrous or stringy roots; that is, many small strings or wires, springing altogether from the bottom of the plant, (by the bottom I mean the commissure of the superficies, or part above ground and the root) and not one single body of a root, divided afterwards into branches and fibres. In a barley-corn I have observed six of these fibres or strings put forth before the blade began to stir.

“ The pulp of these seeds serves for the nourishment of the young plant when tender, notwithstanding it hath drawn root, as the yolk for the chicken's nourishment for a while after it is excluded, notwithstanding that it can feed itself
“ by

" by the mouth. This may be evidently demonstrated so to be in corn newly sown : for if you pluck of it up at first springing, you shall find the pulp in the grain almost entire ; but afterwards plucking of it up from day to day, as it is older and older, you shall find still less and less of the pulp remaining, till at last there be nothing left, but the empty husk sticking to the bottom of the plant. The pulp is, by the moisture of the earth, strained through the coats of the seed, dissolved into a cremor like chyle or batter.

" In such of these seeds, as are covered only with thinner teguments, as for example, wheat and rye, the leaf breaks the teguments, and comes forth at the same end with the roots : in others, that are covered with thick husks, as barley and oats, the leaf creeps under the grosser husk to the opposite end, and there comes forth ; notwithstanding that the germin or young plant is made up alike and affixed to the same end of the grain ; and the first shooting of both, leaf and root, be from the same point, as well in this kind as in the other.

" Of the second sort of seeds, in which the embryon-plant bears but a small proportion to the pulp of the seed ; viz. such, in which it is inclosed in the middle of the pulp, as it were a pith, are 1. Pine-seeds, and I believe the seeds of all other coniferous and resiniferous trees, in the kernels whereof you may find a young pine-tree, perfectly formed, stem and leaves, as it appears at first coming up out of the ground. 2. Ash-seeds ; in the middle of whose pulp you may find a little stem with two elegant leaves, not winged as the after-leaves are, but like two single lobes of the after-leaves ; so that this tree seems to belong to the genus of those, whose seed is divided into two lobes, and comes up with two seed-leaves, whereas really it doth not. 3. Flower de luce seeds. 4. Asparagus seeds : in both these last the pulp of the seed, all but the embryon-plant, is of a gristly substance ; which, whether it serves for nourishment or defence of the young plant, I know not. These seeds of this kind I have observed, and question not but there are many others of like nature.

" In these and the former sort of seeds is true, what a great while since I published as a *general* observation ; viz. that the seed at least in most plants did contain, besides the young plant, a convenient portion of nourishment for it while yet tender. But now I find in the most plants it holdeth not ; for the far greatest number of seeds contain nothing of nourishment for the young plant, more than the pulp of the lobes ; which yet may, and most probably doth, supply nourishment to the radicle, while it is shot forth, and comes to draw from the ground for itself, and reciprocally for them too. For the lobes or seed-leaves in most seeds, while yet included, are thick, pulpy, and brittle ; and consequently have little of fibre, and much of flesh.

" Of the second sort ; viz. those, in which the included plant makes up the whole pulp of the seed, are (I suppose) all bulbous plants : for, that these have no seed-leaves, but come up with leaves like the succeeding, is evident ; and at first springing up upon their leaf, the husk of the seed empty, it is most probable, that there was nothing else in the seed but the young plant : for, had
" there

“there been any thing in the feed of nourishment for the young plant, most probable it is, that the husk being the vessel containing such nourishment, should remain fastened to the bottom of the plant, and not be brought up with the leaf. The next spring, I intend (God willing) by ocular inspection to determine this, and not to go upon probabilities.

“All seeds, when fallen from their plants on the earth, do at first draw their nourishment by the pores of their coats or teguments.

“There is great analogy between the nourishment and growth of the seeds of plants in the earth, and those of viviparous animals in the womb. For, as the seed of a plant, when ripe, falls to the ground, and there lying loose doth (as I said) first receive its nourishment by the pores of its teguments, and afterwards strikes root into the earth: so likewise the seed or egg of a viviparous animal, when ripened, as it were by the male, drops off one of the ovaria into the womb, where it lies for a while loose and free, without any adhesion to, or connection with, the womb; drawing its nourishment through its involving membranes or secundines, and afterwards striking, as it were, root into the womb, fastens itself to it, and then probably draws at least part of its nourishment that way: and in this respect, a man, as all other animals, may be said to live first the life of a plant. By the ovaria, I mean the bodies usually called testes feminini, which whosoever will but make use of his eyes, diligently to view in swine, and other multiparous and salacious animals, must needs acknowledge to be nothing else but masses or clusters of eggs.

“Neither do the seeds, but I believe the roots of plants also, draw the greatest part of their nourishment by the pores of their coats or barks, and but little by the extremities of their capillary fibres, which yet some have made to be so many oscula or little mouths in plants, answering one great one in animals. That plants do draw by the pores of their barks, is evident from that manner of planting branches or slips of trees and shrubs mentioned by LAUREMBERGIUS. First cut off the lower end of the slip to be planted, and having sealed it close up, put it into the ground bent, the middle of the bow being lowermost, and the lower or sealed end inclining upwards, yet so as to remain still covered with the earth, the upper end only appearing above ground. For in this case the nourishment can get in no way but by the pores of the bark, at least if there be only one internodium covered.

“And now, that I have mentioned this way of planting by the slip, I shall add, that I cannot but think it would be worth the while to practise it in all sorts of apple-trees, as well as in codlings and moys; this being, of all others, if it will succeed, the most easy and speedy way of propagation. For, though a graft may bear fruit as soon as a slip, yet is the stock some years growing before it be fit to graft on; and then, a slip growing much faster will bear abundantly more fruit than a graft of its standing. Now that it will succeed, I think most probable; there being no reason, why one tree of the same genus should grow of the slip, and not another, though perchance with more difficulty. In

“this

" this opinion I was much confirmed by what I found in Mr. JOSSELYN's description of New England, viz. That the inhabitants there do practise, with good success, this manner of propagating all sorts of fruit-trees. If it be said, that trees thus planted will be shorter lived, and not last so long as those that are grafted; I answer: 1. I doubt much, whether this hath been sufficiently observed, and not rather presumed, and taken up on weak and insufficient grounds. For there seems to me to be the same reason, why a graft should be short-lived, as why a slip, which I conceive is, because both of them have already past their nonage, and are arrived at the age of fecundity, being taken off branches already fruitful; and therefore all the time spent from the springing of the seed till its maturity is cut off from their lives, which is no disadvantage to the planter, the seed-plants remaining all that time unfruitful. 2. Suppose it were so as is said, the suddenness and copiousness of their bearing will abundantly compensate the shortness of their duration. For those, that last longer, are longer before they come to bear, and till that time they do unprofitably cumber the ground; whereas these are profitable soon after the time of their first setting; and when they come to be effete, they may then be cut down, and others planted in their room."

A discourse on the specific differences of plants.

" Having observed, that most herbarists mistaking many accidents for notes of specific distinction, which indeed are not, have unnecessarily multiplied beings, contrary to that well known philosophic precept; I think it may not be unuseful, in order to the determining of the number of species more certainly and agreeably to nature, to enumerate such accidents, and then give my reasons, why I judge them not sufficient to infer a specific difference.

" First then, such accidents are either of the whole plant or of the root, or of the stalk, or of the leaf, or of the flower, or of the fruit, or of the seed.

" 1. Of the whole plant, difference of magnitude from what is usual: so in GERARD's and PARKINSON's herbals we find many plants put down for distinct species, which themselves confess to differ in no other point, than being in all parts less or greater than others of their kind before described. To which I might add difference of scent and taste, for which they make a sort of wormwood, different in kind from the common, calling it *absinthium infipidum* & *inodorum*.

" Accidents of the root mistaken for notes of specific difference are, first, diversity of colour; instances whereof we have in carrots, turneps, and radish; the root of the first, besides the usual colour, being found sometimes of a dark red or purple, sometimes white; that of the second sometimes yellow; that of the third, sometimes white, and sometimes black. Secondly, diversity of figure observed in turneps; which are sometimes long, though commonly round-root.

“ 3. Differences of the stalk are its degenerating in many plants into a broad and flat figure, or varying its number of angles, as in purple loose-strife.

“ 4. Accidents of the leaf are 1. Variegation, painting, stripping, or gilding. Few plants there are but their leaves will now and then happen to be thus painted: but those, that are most prized, and charily nursed up in gardens, are painted holly, alaternus, box, rosemary, bitterweet, sage, hyssop, mint, marjoram, tansy, melilot. 2. Curling of the edges of the leaves, observed in lettuce, endive, mint, parsley, tansy, garden-cress, hart's-tongue. Though in this accident, I confess myself not fully satisfied, that it is not a note of specific distinction.

“ 5. Accidents of the flower are, 1. Variety of colour, as white or carnation, in such as are naturally blue, red, or purple: scarce any plant of such a coloured flower but is sometimes found with a white one. Here by the by we may take notice, that plants of yellow flowers seldom change colour, growing wild, tho' in gardens sometimes they do, as I found in my own garden, in yellow-flowered moth-mullein, the seed whereof sowing itself, gave me some plants with a white flower. I never yet observed any one of the numerous family of hawkweeds to vary the colour of the flower. Besides these diversities of colour common to many flowers, there are other almost infinite varieties in July-flowers, tulips, anemonies, lark-spurs, columbines, bears-ears, poppies, stock gilliflowers and others.

“ 2. Multiplicity of leaves, or doubleness of the flower; of which instances are infinite. Yet some whole tribes of plants were never, that I know of, observed to produce double flowers; as for example, the umbelliferous, verticillati and papilionaceous kinds.

“ 3. Gerniation of the flower, in such as we call hose in hose, which is a variety, for ought I know, peculiar to primroses, cowslips, and paigles.

“ 4. Nakedness of the flower in such as have it usually radiate, as is observed in camomile, mayweed, feverfew, and the like.

“ 5. Fistulousness or hollowness of the flower-leaves in such as have them usually flat, as is seen in the double-daisy and African marygold.

“ 6. Proliferousness of the flower in childing daisy, scabious and other plants with a compound flower:

“ 6. Accidents of the fruit are differences of magnitude, taste, figure, colour which are in apples, pears, and plums, almost infinite.

“ Lastly, accidents of the seed are variety of colour observable in the seed of millet, which is found of a yellow and golden colour; of maize or Indian wheat,

"wheat, which is sometimes spadiceous; of common beans, which are sometimes red; and of kidney-beans, which are of many differing colours.

"Having now enumerated the accidents, it remains that I give my reasons, why I judge them not sufficient notes of specific distinction.

"First, as to the difference of magnitude; though I grant there are certain measures or bounds of littleness and greatness, which neither plants nor animals of the same species can exceed or fall short of; as, for example, a sheep can never come to be so big as an elephant, or so little as a mouse; nor a gooseberry-bush so tall as an oak, or so low as millegrana: yet is there a very great latitude in point of magnitude between plants of the same species, of ten sometimes to one, which yet is wholly to be imputed either to the richness or poverty of the soil, the moistness or drought of the season, the coldness or heat of the climate, or some other such like external circumstances, and not to the specific nature of the plant: which is evident in that, if you take the seed of the smallest and poorest plant in its kind, provided it will admit culture, and sow it in a rich soil, you shall soon get an offspring ten times as great as the mother-plant. Nay, take the root of a perennial and removeable plant from off a cold barren mountain, and set it in a fat warm garden, it shall attain twice the stature and dimensions, which it would have been confined to, had it remained in its natural place. No less difference is there, in this respect, between animals of the same species; we having in England of sheep from five to fifty pounds a score, and of beeves from three to twenty pounds a-head. And for horses, I have seen many in New Wales, that for bigness did not exceed some dogs; and for price were rated at no more than half a crown or ten groats a-piece.

"2dly, Variegation of leaves in gilded box, rosemary, and the like, is so far from being a mark of specific difference, that it is only a symptom of a morbid constitution of such plant, induced by the application of lime, rubbish, or other mixture to the root of it.

"3dly, Diversity of colour in the flower, or taste in the fruit, is no better note of specific difference in plants, than the like varieties of hair or skin, or taste of flesh in animals; so that one may, with as good reason, admit a blackmore and European to be two species of men, or a black cow and a white to be two sorts of kine, as two plants, differing only in colour of flower, to be specifically distinct; such varieties, both in animals and plants, being occasioned either by diversity of climate, and temperature of the air, or of nourishment and manner of living.

"1. What influence diversity of climate, place, or temperature of the air may have as to the alteration of these qualities, appears in many animals, which on the Alps and other high mountains, as also in those cold and northern countries, where the earth for more than half the year is continually covered with snow, are not rarely found white, though naturally of different colours: as for example, bears, foxes, hares, ravens, blackbirds. I know not, whether I ought

“ to refer to this head, or that of the diversity of nourishment, the difference
 “ between English and Flemish horses; and between our English Lancashire and
 “ Suffex beasts, of which the former have fair and well spread horns, the latter
 “ small and crumpled; and, if out of Lancashire you translate these cattle into
 “ Suffex, their race by degrees will degenerate, and come to be of the shape of
 “ the natives.

“ 2. The like, and greater, influence hath the diversity and plenty of food,
 “ and different manner of living, as is manifest in domestic animals; for example,
 “ swine, ducks, and geese, which do frequently and almost infinitely vary their
 “ colours; whereas the wild, of those kinds, retain constantly the same, and not
 “ their colours only, but also the tastes of their flesh; it requiring no very critical
 “ palate to distinguish by the taste, of flesh of tame and wild fowl: nay, it hath
 “ been told me for a truth by persons of good credit, that there is a pasture on
 “ a hill called Haselbedge, near Little Hucklow in the Peak of Derbyshire, which
 “ will turn the hair of all kine, that feed upon it, in three years time to a grey
 “ colour. Of all other animals, dogs are by these circumstances most diversifi-
 “ ed, insomuch, that many animals of different species differ not more in shape,
 “ magnitude, colour, and several other accidents, than they do. Now, if diver-
 “ sity of food, climate, and such like accidents, may effect such differences
 “ among animals of the same species, much more may they among plants,
 “ which are less free in the choice of their nourishment, and constantly affixed
 “ to the place where they chance to spring up.

“ 4. I prove in general, that none of the forementioned varieties are distinct
 “ species, because they will spring frequently from the seed of the same indi-
 “ vidual plant.

“ 5. Because by seed they will not propagate their kind, but give you plants
 “ of the usual figure and colour; the only sure way to propagate such plants
 “ being by off-sets from the root, if they be bulbous, or by slips and branches,
 “ if others.

“ 6. Many of these varieties, if they stand long in one place without culture,
 “ will by degrees degenerate, becoming of double, single-flowered, and changing
 “ from rare to common colours. I might add, as a further argument, that I
 “ have observed on the same root, for example, of a stock gillyflower some
 “ flowers single and some double.

“ But, because these varieties of flowers, for their beauty and rarity, are highly
 “ prized and desired by the curious; and those of fruits do no less gratify the
 “ palate than these the eye, it were desirable to know certainly, how such va-
 “ rieties might be produced. First, one means to advance plants from single
 “ to double flowered is by frequent removals. LAUREMBERGIUS saith*, that
 “ he hath often tried in julyflowers, and found, that single ones, by being re-

* Horticult. lib. 1. cap. 28. § 3.

“ moved

“ moved first in the spring, then in the autumn, and afterwards again the spring following, and not permitted to flower in the mean time, have all come to bear double flowers. 2. One means to diversify the colour of the flower is, by watering them only with water deeply tinged with the colour you would have the flower to be of. LAUREMBERGIUS, in several places of his book de Horticultura, inculcates this experiment, lib. 1. cap. 31. § 5. Item, cap. 19. § 10. and cap. 13. § 6. he thus prescribes the manner of making it: Fill a vessel of what size or fashion you please with very fat earth, dried in the sun or sifted, and therein plant a slip or branch of a plant bearing a white flower (for such only can be tinged;) use no other water to water it with, but such as is tinged with red, if you desire red flowers, with green, if green, &c. With such coloured water water it twice a day, morning and evening, removing it into a house by night, so that it drink not of the morning or evening dew for three weeks space. You shall (saith he) experience, that it will produce flowers tinged, not altogether with that colour, wherewith you watered it, but partly with that, partly with the natural.

“ 3. The most sure and facil way to get plants different, either in colour or multiplicity of flower, is to sow the seeds of those plants, of which you desire such varieties, in a rich soil, or one different from what is natural to such plants when wild. For, if you sow the seed, for example, of a single july-flower in good ground, among many that bear single flowers, it shall give you some roots, that yield double, and some of different colours, from the mother-plant, which you may afterward propagate by the slip. The plants, that are most apt to be thus diversified by sowing, are july-flowers, anemones, lark-spurs, columbines, bears ears, stocks, and wall-flowers, primroses and cowslips, tulips, crocuses, blue-bottles, daisies, hepaticas, and violets.

“ As for fruits, the ready, and, I believe, only way to get new kinds is by sowing their seeds, stones, or kernels, in rich ground, or, perchance, any common ground, which will give you wildings, bearing fruit of a different figure, colour, magnitude, or taste, from the tree of which they came, whose tastes may be mended and improved by culture and insition. But that by insitions only new species of fruits may be produced, is to me incredible, I having hitherto embraced, as an undoubted maxim in planting, that the fruit always follows the cyon.

“ By this way of sowing may new varieties of flowers and fruits be still produced in infinitum, which affords me another argument to prove them not specifically distinct; the number of species being in nature certain and determinate, as is generally acknowledged by philosophers, and might be proved also by divine authority, God having finished his works of creation, that is, consummated the number of species, in six days.”

Mr. Hooke produced and explained his model for horizontal sails, being persuaded, that he had improved that position of sails to the greatest perfection; of which:

which it was capable; since those sails could not, in his opinion, be put in any posture more advantageous than that, which he exhibited.

It being mentioned, that there would be a total eclipse of the moon on the 1st of January next; and intimated wishal, that Sir WILLIAM PETTY had erected a very convenient observatory at his own house; Mr. HOOKE was desired to assist there in making observation of the said eclipse, and to provide instruments necessary for it.

1674. January 7. A letter from Dr. LISTER to Mr. OLDENBURG, dated at York, November 24, 1674, was read, concerning some observations and experiments, viz:

1. Of the efflorescence of certain mineral globes. 2. An odd figured iris. 3. Of a *glossopetra tricusps non serrata*. 4. Of certain *lapides Judaici*, for kind found in England. 5. Of the electrical power of stones in relation to a vegetable rosin. 6. Of the flower and seeds of mushrooms. 7. Of the speedy vitrifying of the whole body of antimony by cawk. This letter was ordered to be entered¹, and the author desired to perfect and publish it. The several substances accompanying it were delivered to Mr. HOOKE for the repository. And it being thought, that the vitrified antimony might serve for perspectives, Mr. OLDENBURG was desired to write to Mr. LISTER for some quantity of that cawk, employed in the vitrification.

Mr. OLDENBURG presented from Mr. BOYLE his newly printed book, intitled *Traits, containing*, 1. *Suspensions about some hidden qualities of the air; with an appendix touching celestial magnets, and some other particulars*. 2. *Animadversions upon Sir H-bbes's Problemata de Vacuo*. 3. *A discourse of the cause of attraction by suction*: printed at London, 1674, in 8vo.

Mr. OLDENBURG delivered to Mr. HOOKE three papers concerning Mr. HENSHAW's presents lately made to the Society.

Dr. DANIEL COXE presented the Society with a bottle full of the volatile spirit and salt of wormwood, extracted in the manner published by him; which liquor was as pungent as any volatile salt of hartshorn or foot, &c. can be.

January 14. At a meeting of the COUNCIL were present

Sir WILLIAM PETTY, vice-president, in the chair,	
The earl of Aylesbury,	Dr. WHISTLER,
Sir JAMES SHAEN,	Mr. COLWALL,
Mr. HENSHAW,	Mr. HILL,
Mr. PEPYS,	Mr. OLDENBURG.
Dr. GODDARD,	

¹ Letter-book, vol. vii. p. 112: It is printed in the *Philos. Transact.* vol. ix. n^o 110. p. 221. for January, 1674.

1677.] ROYAL SOCIETY OF LONDON.

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The committee for disposing of the four hundred pounds legacy upon fee-farm rents being called upon for a report, Mr. HILL reported from Sir JOHN LOWTHICK and Sir JOHN BARKER, that they had found upon the books three fee-farm rents payable from Lewes in Sussex (whereof one from the estate of the earl marshal) amounting in all to twenty-four pounds per ann.

The consideration of this was referred to the next meeting of the council.

No report was ready from the committee for considering of the disposing of Chelsea College.

Several members of the council named the respective days, when they would provide each a discourse for the Society, viz.

The earl of Aylebury

Mr. HENSHAW

Mr. JAMES SHAEN the first meeting after Easter.

Mr. PEPYS the second meeting after the next recess, the president being said by him to have named for himself the first meeting-day after the second recess.

February 11, 1677.
18.

Mr. EVELYN of the Society took the 1st of April, 1677.

Sir WILLIAM PETTY having proposed Mr. BARLOW as a person fit to collect the arrears due to the Society, it was ordered, that the said Mr. BARLOW be employed for that purpose, he giving his bond of one hundred pounds for his fidelity, in delivering the monies by him collected to Mr. DANIEL COLWALL, as treasurer to the Royal Society; and that he, the said collector, do from time to time receive the respective orders from Mr. COLWALL as to the persons being in arrears, and the respective sums due from them; and that he be allowed twelve pence per pound for all such sums as shall have been collected and brought in by him.

At a meeting of the Society on the same day,

Sir PAUL WYNCOTT, Bart. and Mr. MILES were elected.

Mr. HOOKS read his observations of the late lunar eclipse of January 1st, at which were present the presidents, Sir JONAS MOORE, and Mr. COLLINS. He was desired to publish this discourse, and to publish it.

There was read out of the Register Mr. BOX-LEE's discourse of freezing, formerly November, 1671. Sec above, vol. ii. p. 492.

This.

^a See Philosoph. Transact. vol. ix. p. 177.

This gave occasion to suggest several experiments to be made, as, 1. To exhaust water, both boiled and raw, of air, in order to see, whether it would swell as much, as if not exhausted. 2. To tinge several liquors both with vegetable tinctures and mineral ones, as with Roman vitrol, verdigrisee, &c. 3. To mix burnt alabaster and water together, to see the force of the extension of that mixture.

January 21. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,

Sir JOHN BANKES,

Mr. HENSHAW,

Mr. PEPYS,

Mr. HOSKYNs,

Dr. GODDARD,

Mr. COLWALL,

Mr. HILL,

Mr. OLDENBURG.

Sir JOHN BANKES made a full report concerning the three fee-farm rents payable from Lewes in Suffex; concerning which the council accepted of the proposal, and resolved to dispose of the four hundred pounds legacy of the late Dr. WILKINS, bishop of Chester, for purchasing of them; and accordingly desired Mr. HOSKYNs to take care of a legal conveyance of the same to the Royal Society and their successors.

A report being made, that about sixty fellows of the Society had signed and sealed the new obligation, which was the number, that was thought fit to be assured of before the sending about the printed declarations, it was resolved upon, that a letter should be drawn up by the secretary against the next meeting of the council, to accompany the several copies of the declaration, to be sent to all such, as were not excepted by the same: and that the substance of that letter be to desire the respective members to consider the contents of that declaration, and to return an answer thereunto within such a time, as should be limited by the president, who was to sign both the letter and the declaration.

It being considered, that the forty shillings to be paid by those members of the council, who should fail of giving a lecture, would not be esteemed a sufficient recompense to him, who should supply their place, it was agreed, that forty shillings should be added thereto out of the stock of the Society.

Mr. OLDENBURG mentioned, that the earl of Aylesbury being obliged to go out of town, could not take care of providing a lecture, as he thought to have done for the 11th of February, and had therefore sent to him his forty shillings: which money was delivered to the treasurer.

It was ordered, that a discourse made before the Society, 10th December, 1674, by Dr. NEHEMIAH GREW concerning the nature, causes, and power of mixture, be printed by the printer of the Society.

At a meeting of the SOCIETY on the same day,

Sir

Sir ROBERT SOUTHWELL presented to the Society for the repository a very curious hammock made of the bark of a tree.

Dr. DANIEL COXE entertained the Society with a lecture concerning the analysis of vegetables, dividing his subject into several heads, which, he said, had furnished him with matter sufficient for several lectures.

This lecture treated chiefly of the several methods of analysing plants.

It gave occasion of debating the question, whether there were no alcalifate salt but by burning? And, whether some particles of the air did not unite with some parts of the vegetables burned, precipitating themselves with them, and so forming an alkali?

It gave likewise occasion to debate Mr. HOOKE's notion of the nature of trees, viz. that it consists in the dissolution of bodies by air.

Mr. HOOKE intimated also upon occasion, that he hoped he should be able to make it out, that a body may be made springy out of particles, that have no spring.

He was desired to endeavour to prove this by experiment as soon as he could.

January 28. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,

Sir JOHN LOWTHER,

Mr. HENSHAW,

Sir JAMES SHAEN,

Dr. GODDARD,

Sir WILLIAM PETTY,

Mr. COLWALL,

Sir WILLIAM SOUTHWELL,

Mr. HILL,

Sir JOHN BANKES,

Mr. OLDENBURG.

Sir JOHN BANKES produced the conveyance of the twenty-four pounds fee-farm rents yearly, payable from Lewes in Suffex.

It was ordered, that the 400 pounds, being the legacy of the late Dr. WILKINS to the Society, should be paid out to Sir JOHN BANKES for the said conveyance: and that the president, treasurer, and secretary be desired to bring with them on the Thursday following the three keys of the iron chest, which contains the money.

There was read a draught of a letter to be sent to those, who had not signed the new bond, whether in London, or absent from it; together with a copy of the printed declaration. The time for an answer limited to those, who were in London, was the 11th of February following: the time for the absent was a month from the date of the respective letters to them.

It was ordered, that the amanuensis make fair copies of this letter, first of all to the following persons :

The lord ANNESLEY,
Sir ROBERT ATKYNS,
Sir CHARLES BEKKLEY,
Sir JOHN BIRKENHEAD,
The lord BRERETON,
Mr. GILBERT BURNET,
Sir EDWARD BYSSHE,
Mr. CARKESSE,
The earl of Carlisle,
The lord CAVENDISH,
The lord bishop of Chester,
Sir WINSTONE CHURCHILL,
The lord CLIFFORD,
Capt. COCKE,
Col. COLEPEPPER,
Dr. THOMAS COX,
The marquis of Dorchester,
The earl of Dorset,
Dr. DOWNS,
Sir GEORGE ENT,
The lord viscount FITZHARDING,
Mr. HOARE,
Dr. HOLDER,

Mr. LOCKE,
Sir JAMES LONG,
Dr. MERRET,
Mr. NOLTHROPE,
Sir THOMAS NOTTE,
The earl of Northampton,
Mr. OUDART,
Dr. SAMUEL PARKER,
Sir PETER PETT,
The earl of Peterborough,
Mr. POVEY,
Lord viscount RANALAGH,
Mr. SLINGSBY,
Mr. SOAME,
Sir JOHN TALBOT,
Mr. WALLER,
Dr. WILLIS,
Dr. WOODFORD,
Dr. WOODROFFE,
Dr. THOMAS WREN,
Mr. WYNDE,
Lord viscount YARMOUTH.

The president signified, that he would make his discourse at the first meeting of the Society after the next recess.

Mr. PEPYS offered to make his the next week after the president.

Sir WILLIAM PETTY the next after Mr. PEPYS.

Sir ROBERT SOUTHWELL took for his discourse the 2d week in April, as Mr. EVELYN had done the first week in that month.

Mr. OLDENBURG having desired the council's license for the printing Dr. WALLIS's discourse on gravity and gravitation, made before the Society the 12th November, 1674, it was

Ordered, that the said discourse be printed by the printer of the Society.

Mr. OLDENBURG having mentioned, that Mr. NEWTON had intimated his being now in such circumstances, that he desired to be excused from the weekly payments, it was agreed to by the council, that he should be dispensed with, as several others were.

At a meeting of the Society on the same day,

Dr. EDMUND CASTELL was admitted.

Mr. HOOKE read his discourse concerning his new contrivance of a Helioscope and divers other useful instruments¹. The helioscope was for observing the sun without offending the tenderest eye by the help of several reflecting-glasses weakening the strokes of the sun-beams.

It was ordered, that the helioscope should be fixed and tried on the first sun-shiny-day.

It was intimated, that a good composition of metal for reflecting was very desirable.

Mr. OLDENBURG produced Signor MALPIGHI's philosophical present concerning the anatomy of plants both in a manuscript discourse and very elegant figures sent to him from Venice by sea.

Signor MALPIGHI's letter to Mr. OLDENBURG, dated at Bologna, 20th August, 1674², accompanying this present, was read.

It was ordered, that a letter of solemn thanks to the author should be drawn up³; and the council be desired to consider of a way of having it well printed.

A letter of Monf. HUYGENS to Mr. OLDENBURG, dated at Paris, 30th January, 167 $\frac{1}{2}$ ⁴, was read, giving notice of a new invention of watches by himself, the secret of which he conceals in an anagram,

4 1 3 5 3 7 3 1 2 3 4 3 2 4 2
viz. a. b. c. e. f. l. l. m. n. o. r. l. t. u. x.

February 4. Sir PHILIP PERCIVAL, Bart. was proposed candidate by Sir ROBERT SOUTHWELL.

Dr. KING presented to the Society his discourse, consisting of the following particulars:

1. That most, if not all, the parts of an animal body do consist of tubes and liquors.
2. That all the vessels of the body are chiefly made up of other vessels.

¹ Mr. HOOKE's *Description of helioscopes and some other instruments made by him*, was printed at London, 1675, in 4to.

² Letter-book, vol. vii. p. 100.

³ Mr. OLDENBURG's letter to Signor MALPIGHI was dated 26th February, 167 $\frac{1}{2}$, and entered in the Letter book, vol. vii. p. 200.

⁴ *Ibid.* p. 125.

3. That all vessels and other tubular parts have their share of carneous or other moving fibres, and act in their several spheres as the muscles.

4. That all the contents of all tubular parts are carried about into all parts of the body, or out of it, according as they are severally designed, by muscular motion voluntary or involuntary.

5. That most diseases, which our bodies are afflicted with, take their principal rise from the impeded or irregular motion of the liquors and spirits, or their increments left in the tubes or cavities.

6. Some observations upon the composition and motion of membranes.

7. The manner of the circulation of the blood, grounded upon the fabric of the heart and arteries.

He was desired to leave his discourse to be registered with the rest, which he promised to do, as soon as he had revised it *.

Upon the occasion given by this discourse concerning muscular motion Mr. Hooke declared, that he had made some discovery of the structure of a muscle by inspection with a microscope.

Dr. GREW supposing, that that discovery might have been the same with what he had some time since discovered, acquainted the Society, that he had some time since discovered, that the fleshy part of a muscle was divided into a sort of long parallelopipeds by the cross interweaving of small membranes and vessels crossing the said fleshy part.

Dr. CROUNE supposed these fleshy parallelopipeds to consist of a chain of bladders, which being blown up by certain liquors shorten the said springs, and so contract the muscle.

But Mr. Hooke affirmed, that he could not discover any such texture in the said fleshy part, but that his observation was, that the fleshy part of a muscle consists of an infinite number of exceedingly small round pipes, extended between the two tendons of the muscle, and seem to end in these: which tendons in the muscles of beef boiled would be easily stripped off from the ends of those pipes, and so leave the ends of the round pipes very distinct. He said, that the reason of the moving of a muscle might be from the filling or emptying of those pipes, whose sides seem to be flexible like those of a gut.

They were all desired to make out their respective notions about the fabric of muscles by ocular demonstration.

* It does not appear in the Register.

February 11. Sir PAUL WHICHCOTE and Mr. DANIEL MILLES were elected.

Dr. CROUNE read his discourse concerning the manner, how flying is performed by birds; shewing, in order thereunto, the structure of a duck's wing and body, especially of the muscles and their insertions into the humerus.

This discourse was ordered to be registered^s, though the doctor did not then leave it with the Society.

He having intimated a quite different structure of the body of man from that of birds, and thence concluded his utter unfitness for flying, gave occasion to some of the members to remark, that what nature had denied to the body of man, might be supplied by his reason and by art.

Mr. HOOKE intimated, that there was a way, which he knew, to produce strength, so as to give to one man the strength of ten or twenty men or more, and to contrive muscles for him of an equivalent strength to those in birds. He hinted likewise, that a contrivance might be made of something more proper for the feet of man to tread the air, than for his arms to beat the air.

Sir WILLIAM PETTY mentioned, that perhaps it might prove of use to consider, whether gun-powder, being of so great and quick a force, might not be slackened to give a slower motion, as in the mortar-piece the shell is much more slowly carried through the air than a bullet out of a musket.

Some said, that it would be of real use to contrive something for flying, if it were but to raise a man so high, as to fly over a wall, and the besiegers of a town to carry and bring back intelligence.

Mr. OLDENBURG read a letter to him from Monf. BULLIALDUS, dated at Paris, 6th February 1674^t, concerning the observations of the royal academy of sciences and his own of the lunar eclipse of 27th January preceding[†]; as also his opinion about telescopical sights, declaring himself of that of Mr. HEVELIUS.

It was ordered, that the observations that eclipse made in England should be sent to Monf. BULLIALDUS, according to his desire.

February 18. Mr. ISAAC NEWTON, JAMES HOARE, ^{junior}, Esq; were admitted.

Sir PHILIP PERCIVAL was elected.

Mr. HENSHAW read his discourse, giving an account of his observations made

^s It does not appear in the Register.

^t Letter-book, vol. vii. p. 227.

[†] They are printed in the Philosoph. Transact. vol. ix. n^o 111. p. 238. for February, 1673.

In Denmark and in his voyage thither ; which was ordered to be registered¹, and is as follows :

My Lord,

" It being appointed me, this day, to entertain this learned meeting, with a discourse of some matters relating to experimental philosophy, made me consider, that though from my childhood I have ever had a great affection and inclination to the speculations of Natural Philosophy ; yet the great troubles I have had for many years, concerning my own private estate, have in a manner wholly diverted me from making any considerable progress in that science ; and since that my time hath been almost wholly taken up for near three years, last past, by the duties of an employment in Denmark his majesty was pleased to honour me with : so that, instead of better digested notions my study might have furnished me with had I had leisure, I here adventure to offer you some occasional observations about natural things, I made in my voyage to Denmark, and during my abode in that country, which, I hope, will not be thought to deviate much from the design of these weekly exercises ; since inquiries into the histories of all countries are part of your method for the advancement of science ; and, though I am sure the observations I here present you will be very crude, for the want I had of skill and leisure better to concoct them, yet they may serve for incitements to those of greater ability and curiosity to perfect them.

" The first thing then, that I considered more heedfully than I had done in any former voyage I had made, was, that when a ship of a considerable burthen had sailed from us little more than a league or three miles (as the seamen judged) we lost the sight of almost all her hull or body, and in a short time after could see nothing but her masts and sails. I was standing then on the quarter-deck of a frigate of the king's, of fifty guns, called the Portland, where, as I guess, my feet were about eighteen foot from the water, consequently my eye five foot higher, and the highest part of the body of the other ship was, as I judged, about fifteen foot above the water. I had formerly, on the like occasions, satisfied myself, that it was the convexity only of the water, that thus took away the sight of a ship from us at so small a distance ; but at that time, considering with myself, that if the circumference of this globe of earth and water we inhabit, were but, as it is vulgarly reputed, twenty-one thousand and six hundred miles (though I did not give myself the trouble to try, whether I was able to calculate what the sinus versus of an arch of three miles of that circumference might come to) it was highly improbable, that the convexity of so small an arch could be so great, as wholly to intercept the body of a ship fifteen foot high from an eye raised twenty-three foot above the water. Therefore having in my cabin three perspectives of Mr. Coek's making, fitted with day-glasses, the one of two foot, the other of four, the third of six foot length ; I was resolved to try what they could discover to me ; and according y^e, getting them in a readiness, when the next ship sailed by, just as, to my eyes, we lost the sight of her hull, I applied the two foot tube, and found I did recover sight of

¹ Register, vol. v. p. 53.

" some

“ some part of her hull, with the four foot tube more visibly, and with the six foot tube about half her hull, as near as I could guess. I made the trial two or three times more, with much what the same success, to my apprehension, which made me think, that if I had had a longer tube, I might yet have discovered some more of the hull, that before had disappeared; but I could not repeat this experiment so oft as I desired for my fuller satisfaction; for, what opportunity I had, was while we rid at an anchor wind-bound at the buoy in the gunfleet; and after that, by reason the war was already begun between England and Holland we scarce saw a ship but what failed in our company, till we came to Denmark; so that, upon these small trials I made, it seems to me very probable, that the vaporous and thick air, that floats always above the surface of the sea, intercepts the sight of a ship at so small a distance as a league, much more than the convexity of the water. That, which persuades me, there are continually such vapours hovering near the superficies of the sea, though the air appears never so clear above, and they themselves not perceptible to us, unless we look through them on some object at a known distance, is, *first*, those trembling steams we see every where arise plentifully out of the earth, in a bright day in summer, if we bring our eye near the earth, which we do not at all discover, if we stand upright; whereas the sea must needs exhale them in greater abundance when warmed by the heat of the sun, being a body so easily dissipable, that the very motion of the sea is sufficient to crowd out continually some smaller particles of it; besides what the winds constantly shave off, when they move horizontally on the surface of it, as we may justly conjecture by what they do on ways and wet linen, which dry suddenly in windy weather. And that it is in the nature of vapours to slide, and play, and hold longer together on a moist and smooth superficies, but dissipate and rarify when they get higher up into the air, may be evidenced by blowing tobacco on any liquor spilt on a table, especially if the liquor stagnate with a convexity.

“ The next remarkable thing in our voyage was, that being driven by a south-west wind to near sixty degrees of northern latitude, and coming to an anchor on the 5th of May, 1672, close under the coast of Norway, though the weather was very clear and calm, but cold, we saw the sun three evenings together, near his setting, of a perfect elliptical or oval figure; which sight, I confess, I was the more gratified with, because I have very many times in England attended on his setting at several seasons of the year, to that purpose, though I could never confidently say, I saw it of that figure till this time. The first, that ever we read of, that took notice of this admirable phenomenon was CHRISTOPHER SCHEINER, the jesuit; who also first discovered the spots in the sun, who by chance found out this appearance at Ingolstadt in Bavaria, in the latitude of forty-eight degrees and forty minutes, in the month of September, 1612, as he was one evening at sun-set endeavouring to discover spots in the sun with his bare eyes. He was so surpris’d with so strange an appearance, that he could hardly believe his own sight, till he had verified it by many trials the winter following, especially by transmitting the appearance of the sun through an optic tube on a white paper in a dark room, the way he used to observe the spots in.

“ in the sun by ; but the greatest difference he could discover, at any time between
 “ the diameter of the sun’s longitude and that of his altitude, as he calls them
 “ (though I think the perpendicular and horizontal diameters be more intelligible)
 “ was seven minutes and forty-three seconds, reckoning the sun’s visual diameter
 “ at thirty-four seconds ; whereas in this elliptical appearance of the sun to us
 “ in Norway, the perpendicular diameter seemed shorter to us than the horizontal
 “ by at least a fourth part, as was judged, not only by myself, but also by
 “ several able seamen and others that observed it with me ; that is, as far as we
 “ could estimate it by our bare eyes ; for we had no conveniency to try it SCHEI-
 “ NER’s way. At the beginning of March following, I observed the like ellipti-
 “ cal appearance of the sun for two evenings together, as I went to take the air
 “ in my coach without the north port of Copenhagen, saving that then the per-
 “ pendicular diameter seemed to me, and to two learned men that were in the
 “ coach with me, to be but one fifth part shorter than the horizontal diameter,
 “ and we were both times between the town and the sun when it appeared ; so that
 “ nothing of the smoke of the city was concerned in it. SCHEINER was so taken
 “ with this phenomenon, that he hath written a pretty large treatise in 4to con-
 “ cerning it ; wherein he endeavours to shew the reason of this appearance by an
 “ oblique refraction of the light of a candle, through a glass, that has one super-
 “ ficies convex, the other concave, both ground on segments of the same sphere :
 “ but because every man, that desires that satisfaction, may find it in his book, I
 “ shall forbear to give the particulars of his demonstration ; but if any one, here
 “ present, desires to save himself the trouble, I can tolerably make it out with a
 “ glass in my pocket.

“ After a tedious passage of six weeks at sea by reason of calms, and contrary
 “ winds, that is easterly winds, which commonly in this part of the world are
 “ predominant for three months of the year, that is February, March, and April,
 “ we arrived the 15th of May, 1672, at the town of Elsinœur in Zealand, most
 “ pleasantly seated on that side, which has the greatest command of the Sound,
 “ for though the entrance is four English miles broad, yet the deepest and most
 “ navigable part of it lies close under the walls of the strong castle of Cronen-
 “ burg, situate at the upper end of the town. The weather was pretty warm
 “ there, which made the channels of that town, which are not well contrived to
 “ carry off their fullage, stink so insufferably, that our heads and stomachs were
 “ much disordered by the smell. To refresh myself, as I hoped, I got some
 “ company to walk with me toward the sea shore, but there we were entertained
 “ with a higher degree of the same stink, which came off the shore, and so we
 “ found it almost all the way in our journey to Copenhagen, the high-way lying
 “ almost all the way very near the sea ; it being otherwise the pleasantest pal-
 “ sage of twenty-five miles that ever I rode any where : and this smell is thus
 “ trouble-some all the summer long, whenever the wind has sat for three or four
 “ days from the shore on the other side. I enquired of several, though I confes
 “ no great philosophers, what was the reason of that stink : they could only tell
 “ me, that it was the nature of that sea to smell so in the summer, but that I
 “ quickly found was not so ; for when the wind sat north, south, or west, there
 “ was no ill smell at all ; having, during the time of my abode there, ver: of-

"ten occasion to pass by that shore, I took notice, that almost all along great heaps of sea wrack, or a sea-weed, called in England kelp, such as they lay on the top of barrels of oysters, had been thrown up by the sea in stormy weather. This kelp, when there came no stink from the shore, I found was dry, and being taken up in my hand had scarce any smell at all, but when it stunk it was always wet, the wind from the opposite shore having dashed a great deal of sea-water into it, which in the summer did quickly putrify and stink. It may seem strange to those, who have not been acquainted with the abominable smell of sea-water pumped out of a tight ship (which the scent of this shore did resemble) that salt-water should be apt to stink; and it would have done so to me too, had I not seen the experience of it here in England, that sea-water kept a while in a tub will stink sooner and worse than rain-water: for though we find, that salt preserves flesh and fish, and such like things from putrefaction, because it not only dries up their superfluous moisture, which would quickly colliquate their parts, and lead them to putrefaction, but by entering into all their pores it constipates and consolidates their parts; yet salt in water being to perform neither of these offices, the heat, that is in salt, doth there cooperate with the warmth of the ambient air to promote putrefaction.

"Denmark doth spontaneously produce beech-trees in as great plenty as Sweden doth fir and birch-trees. In all the provinces of Denmark, where I have been, I have observed not only fine groves, but goodly forests, consisting for the most part of beech, and fairer trees of that kind than I have seen any where, which is a kind providence, for so cold a country to be furnished with such store of excellent fuel. The oaks in Zealand are but few, and for the most part crooked, small, and not fit for timber; though in Jutland there is pretty store of them, and many of them of stately growth. There hath formerly, it seems, been greater plenty; for now oak-timber is a commodity prohibited under severe penalties to be carried out of that king's dominions. Neither elms nor fir-trees grow spontaneously in that kingdom, and very few ashes; alders grow in moist places there, but only to shrubs; nor have I seen an alder there big enough to make a hop-pole. Some few maples there are, and those but shrubs. There is great plenty of hazel every where in that country, but especially in the island of Ween, or, as the English call it, the Scarlet Island; so that they lade several barks in that country, at the time of the year, with nuts for Holland. I have been three times in that island; the first time I went on purpose to see what ruins were left of Urani-Burgum, or Tycho Brahe's astronomical palace, but it is now razed to the ground, and only some rubbish of the foundation left. The oaks there are strangely subject to be spoiled by lig' tening more than ever I observed in any other country. Where any oaks grow though encompassed by beeches, I found a considerable number of them hollowed and burnt to a coal within by lightening, though the outward shell grew, and bore branches, and not any of the beeches about them touched by lightening, that I could see. The same thing I found as I rode through great woods in Jutland too. At first I thought they had been set on fire so by poor people or boys to warm them, till I was assured the contrary, and found the like in every wood I came by. Fruit-trees there are not many; yet, in the country, those, that are, are planted

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" by some few of the great men; the rest by Germans and Hollanders, that are be-
 " come inhabitants there, for ornament of their gardens; the rest not being de-
 " lighted with that curiosity, or loath to be at the charge, they having great plenty
 " of apples brought to their markets by sea, at cheap rates, from Mecklenburg
 " and Pomerania; yet the apples, that do grow there, though they are not of very
 " delicate taste raw, yet serve very well for tarts, and keep very firm and sound
 " all winter; but the bergamot-pears that grow there are as good as those of Hol-
 " land, which in my opinion are something more delicate than those of England.
 " Those fruit-trees they have are wonderfully laden with fruit in the season, be-
 " cause they never begin to blossom till the middle of May, when all frosts are
 " over. Cherries grow there in reasonable plenty, but scarce ever grow quite red,
 " and are of a sour taste. Apricots grow there too, but are great rarities, be-
 " cause they have no walls to their gardens; the king's own gardens being but
 " fenced with deal-boards set up an end, but those apricots are little bigger than
 " a man's thumb, though pretty well tasted. Peach-trees I never saw any there;
 " some few vines they have for shade of an arbor or porch, which bear leaves,
 " but never blow toward fruit. Of wild strawberry there is some plenty in the
 " woods; but gooseberries never ripen thoroughly, but serve well enough for tarts:
 " the currants or ribes grow very fair there, they having their plants from Hol-
 " land, but never come to due maturity. Damask or red roses there grow none;
 " but of province-roses great store, which flower from the middle of June to the
 " middle of September; and in the season great store of pretty good tulips are
 " brought to the markets; but the flowers, that most adorn and perfume their
 " houses in May and the beginning of June, are the lilly convallies, which grow
 " in great plenty every where at that time. They have most sort of herbs that
 " are sown every spring; but for mint, they are fain to content themselves with
 " horse-mint, or cat-mint; for spear-mint will hardly grow there. For sage they
 " have only wormwood-sage, such as was brought hither of late years from Scot-
 " land for a rarity. At the king's and queen-mother's gardens they keep in the
 " stoves all winter among their exotic plants, as orange and lemon-trees, &c.
 " (which with that care will hardly live three years) bays and rosemary-trees,
 " gilly-flowers and stock gilly-flowers, our common sage, and several other plants,
 " that endure the winter abroad well with us, but are not proof against the sharp
 " long winters there; yet short sprigs of rosemary are common enough in the
 " markets there, because they sow the seed every spring. But they have many
 " sorts of roots, as carrots, turneps, parsnips, skirrets, which were as good as
 " any where in the world; but, above all, the cabbage of that country much
 " exceeds that of more southern climates. In all the king of Denmark's do-
 " minions there grows no wheat, except (as I was told) a little in the island of
 " Laland; but they have it supplied at easy rates from Germany and Poland. Of
 " rye, barley, and oats, there is plenty, but the two latter, by reason of the
 " early returns of wets and cold by the end of August, are commonly mowed
 " before they are quite turned yellow; and some years they are fain to dry them
 " in ovens. The sheep of that country are most of them black, and the cattle
 " almost all pied of several colours; their flesh is sold very cheap in the market,
 " but it is for the most part lean, they having no good meadows in Zealand;
 " there being but one brook in that great island, and never a river. There is
 " little

" little good fresh water in the island, there being but very few springs. The
 " city of Copenhagen is served with water brought from a lake two miles off in
 " pipes of boreal deal timber; but all the summer long it stinks so, and is so full
 " of worms, that it is loathsome to wash one's hands and face in it; and yet
 " they have no other water to dress their meat with. May is there at reasonable
 " rates, but not very good. Of hens and chickens and ducks there is plenty
 " enough, but all sold lean. Of turkeys and geese (pretty fat)
 " I never saw greater plenty in the markets; so of turkeys and geese (pretty fat)
 " they of their pigeons, and it is but of late years that they sell none young; no more do
 " calves. Rabbits there are none in the country, except a few have killed any
 " the Danes, have a natural abhorrence for them, or else the country were very
 " proper to breed them. For flesh fish, beside what the Baltic Sea brings almost to
 " their doors, as a natural abundance for them, except a few tame ones, and
 " great plenty of plaice. For fish, whiting, flounder, codlings, and excellent
 " standing peels, shrimps, the island of Zealand abounds with
 " which afford them great plenty of carps, pikes, eels, the largest lakes and
 " perches that ever I saw, fair tenches, which are eaten only by the highest
 " the rest despising them, because they have a tradition, that at the first
 " year they are scabby, and have insects like traction, that at the first
 " crosses the English proverb, that says, as found lice found upon the
 " that country are at least twice as big as found lice found upon the
 " choicest pond-fish they have is a fish they call a carp, and excellent
 " roach with his red fins, but it is nearly as big as found lice found upon the
 " ter meat. All the summer time, that country is full of wild
 " wild geese, duck, teal, widgeon, and executioner's time of the
 " hen, wood-cock: the open grounds in September are full of wild
 " plovers, that they rise in flocks of thousands, and are rather larger than
 " chameas there is not one to be seen they make no chase, but are
 " warmer countries; so that all the winter they make no chase, but are
 " to furnish their master's table with a wild the king's hawk, which are
 " tables they are not seen till March, when they are out of season, and being
 " The king's forests are full stocked with ducks, now and then a pair of
 " heads as any I have seen in England, and the penalty being death to carry
 " them without the king's leave. The woods abound with roe deer, which are
 " much bigger than those of the north of England, and are rather larger than
 " prickets with us. Though they are very swift, they make no chase, but are
 " hunted, they quickly endeavour to hide themselves in a bush, and being
 " come and tear them to pieces; so the usual way is shooting of them, every
 " ordinary fellow there has the skill, with a lead in his mouth, to make a calf
 " for them; and, as soon as they hear the sound, they will come near or live
 " jumping toward the noise, and as soon as they discover the men, endeavour to
 " run away again. They are a prohibited game, but, having a placet from that
 " king to kill any roe or hare, I did now and then make bold with them.
 " Jutland there are flocks of wild boars, and in Zealand great plenty of hares;
 " in the Amaker island, which is joined to Copenhagen by a bridge, they are as
 " plentiful as in a hare warren. I have many times seen ten or a dozen of them
 " at one view: in the winter their flew is very grey, and those that are brought

" brought to the market from Schonen are perfect white, but both return to their
 " natural colour in the summer: they are larger much than our hares, but are
 " neither good to course or hunt. In Denmark they never eat any part of a
 " roe, hare, or fat stag, but the chine roasted and larded; the rest they give the
 " dogs. The heathy grounds of that country abound much with juniper and
 " whortleberries; and the blackbirds, thrushes, and field-sparrows, feeding on those
 " berries and haws, are in the first part of winter the best and fattest meat that
 " country affords. The first part of their winter, though it begin something
 " earlier than with us, is wet and cold, but at the rate it is then in England;
 " and any frost that begins there before Christmas seldom continues long. The
 " last winter, which was counted the sharpest any man did remember, began but
 " on the 14th of January; by the 28th the Baltic Sea was frozen quite over, and
 " store of people began to pass from side to side with hay, corn, and oxen; but
 " the Sound, where there commonly runs a strong current, between the two
 " castles, was not quite frozen over till the 8th of February, because there con-
 " tinued a high wind most time of the frost, which was the reason the great belt
 " between Zealand and Funen was not quite frozen over all that winter, though
 " all people accounted it a harder frost than when the late king of Sweden passed
 " over that belt with his army of horse, foot, cannon, and baggage. On the 19th
 " of February last I passed over on foot, between Elsenore and Elsenburg, with
 " a great deal of company with me, and met, not only people passing, as thick
 " as to a fair, with oxen, and waggons laden, but saw many soldiers dragging
 " of great stones of near a tun weight a-piece. They commonly making use of
 " that time of the year to place them under the walls of Cronenburg-Castle, to
 " help to break the force of the waves, which in stormy weather beats furiously
 " on them. In several places near the way where we passed, the country people
 " had made round holes in the ice of about four feet diameter; and, having set
 " up a screen of reeds to keep the north wind off them, so spent the whole
 " day on the ice in fishing at those holes, with lines let down into them with
 " hooks and baits at the end of them. I bought some good soles of them at
 " one of the holes; but that, which chiefly made me go out of my way to them,
 " was, to see the thickness of the ice they had thrown up, which made me won-
 " der, when I saw it was hardly six inches thick, that it could bear such great
 " weights as passed over it: but I satisfied myself, that the water, being contiguous
 " to it, did help to sustain it like a float. But, it seems, the frost sinks much
 " deeper into the earth, than it does into water; for, about the middle of that
 " great frost, accompanying the body of an English woman, that was to be
 " buried in a church-yard, I asked the grave-maker how deep he found the frost
 " did usually penetrate into the ground; he told me a Danish ell and a half, which
 " amounts to about three feet two inches and a half. But this church-yard was
 " in the city, and encompassed with houses, where the cold air could not exercise
 " its utmost power; and, therefore, possibly in the country the frost might sink
 " yet deeper. However this penetration is remarkably deeper than with us about
 " London; for, in that great frost, about five years since, not only my gardener,
 " but several labouring men besides, did assure, that frost did not pierce into
 " ground, that had been broken up, above six inches, and into grass-ground,
 " much less. That the frost is much more penetrating there than in England, I
 " had,

had, not only the testimony of my sense, and the seeing so large a sea crystallized, but having, in a room in my house above stairs, several balkeys of bottles of canary, claret, Norderdown-ale; the claret froze first, then the Norderdown-ale, and at last the canary. Their corks were heaved by the ice out of all the bottles, and the ice was much more spongy than that of common water frozen in bottles; but in all those bottles, there was some little part of the liquor left fluid, which, poured out, was much stronger than the drink whence it proceeded was at first, and when the rest of the ice was melted by the fire, it proved almost as insipid as water. I left all these liquors in their bottles, to be dissolved by degrees, when the thaw came; but, after all, they were never worth drinking. I set bottles of French brandy into the air, they were never freeze, but in the morning there was only some few icy particles whole night to but I several times set some French brandy in a small silver dram floating in it: spirit and strength: by some French brandy into the air, they were never taste. This frost of it was gone; what remained into a very spongy whole night to what time, going without any intermission, continued being of a very spongy floating in it: sea. I saw the Baltic full of floating islands about sending home, my 12th of May, as and, in the woods I rode through, I could not perceive any thing, and my up to freeze: to brisk and vigorous I rode through, I could not perceive any thing, and my up to freeze: return, three green tender leaves, after, the approach of spring, I could not perceive any thing, and my up to freeze: ling there only in May, and the ice was all gone, I could not perceive any thing, and my up to freeze: there, it was a great surprize to find night, in that country, where I was, and my up to freeze: never hear any above forty miles north of London, when it is as warm as in the south, and my up to freeze: the night-ale: there have not so great a variety, when it is as warm as in the south, and my up to freeze: us in England. I suppose it is no news to any one here, that it is as warm as in the south, and my up to freeze: there is not the least appearance of a tide in any one here, that it is as warm as in the south, and my up to freeze: ships of war suffer much by it; they never last long, but perishes long as they last, and my up to freeze: want of a spring tide to bring them into a dock to repair, but perishes long as they last, and my up to freeze: no other way to do it but by careening them. But perishes long as they last, and my up to freeze: hath not leard, that it is not perceivable, that it is true, for the most part, a strong current, but perishes long as they last, and my up to freeze: into that sea, it is not perceivable, that it is true, for the most part, a strong current, but perishes long as they last, and my up to freeze: ward toward the ocean. There is, it is true, for the most part, a strong current, but perishes long as they last, and my up to freeze: rent, that sets in or out at the Sound, which is the mouth, or entrance, of the Baltic, being, as I have said already, not above four miles broad, but that current is wholly guided and dependent on the course of the winds.

"This being what my memory could of a sudden suggest to me concerning the natural history of Denmark, I shall cease to be any further troublesome, and this honourable company."

Upon occasion of what Mr. Henshaw related of the motion of the Baltic Sea, viz. that notwithstanding so many fresh rivers empty themselves into that sea, it is not perceivable, that it hath any motion of its own outwards towards the ocean; that sets in or out at and that indeed there is for the most part a strong current, that sets in or out at the Sound, which is the mouth of the Baltic; but that current is wholly guided by

by the course of the wind: on occasion of this remark, Sir WILLIAM PETTY asked, whether that motion in or out was made with or against the wind. And it being answered, with the wind; Sir WILLIAM related what he had received from captain SHEERES concerning the motion of the Mediterranean, that for nine months of the year, viz. from about February to Alliodontide in November, the ocean sets into the Straits' mouth, and that even when the Levant winds mostly blow against that motion; and that for one month, viz. that of November, the sea sets out into the ocean, and for the remaining two months of December and January, it is, 'as it were, dead water.

Mr. OLDENEURG read a letter to him from Monf. HUYGENS, dated at Paris, 20th February, 1675, N. S. ' concerning a new pocket watch, which he affirmed to go as fast as a pendulum, this letter being an explication of his anagram sent 30th January, viz.

Axis Circuli mobilis affixus in Centro Volute ferreae.*

Mr. HOOKE said, that divers years ago he had had such an invention; and that actually watches had been made according to the same; for which he appealed to the Journal-books, to the *History of the Society*, and to several members of it.

It was ordered, that Monf. HUYGENS, notwithstanding, should be thanked for this communication, and informed what had been done here; and what were the causes of its want of success.

There was shewn from prince RUPERT his embossed map of the Channel between Normandy, Bretagne, and England, and of both the shores:

There was presented from Mr. LISTER some cauk for the vitrifying the whole body of antimony.

February 25. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
The lord bishop of Salisbury,	Mr. Colwall,
Sir JAMES SHAEN,	Mr. Hill,
Sir WILLIAM PETTY,	Mr. Oldenburg.
Mr. Pepys,	

The president enquiring what answers were come in to the printed declaration, Mr. HOOKE delivered a letter of Mr. OUDART, very civilly excusing himself, and alledging reasons for his late omission, and promising compliance with the import of that declaration, as soon as he should be able.

* Letter-book, vol. vii. p. 130.

* See Philosoph. Transact. vol. x. n° 118. p. 440. for October, 1675.

At a meeting of the SOCIETY on the same day,

Dr. GRÆW read his discourses concerning the structure of the cortical, ligneous and medullar part of trees, exemplifying it in several trees, and representing the same by figures.

This discourse was ordered to be registred *; and the author was desired to prosecute this subject.

Mr. HOOKE brought in an artificial head resembling china, made in England, of English clay, so hard and solid, that he said, that nothing would fasten on it, except a diamond; and that it received its polish in the fire.

Dr. DANIEL COXE sent in a paper concerning the improvement of Cornwall by sea-land; the reading of which was referred to the next meeting.

March 4. Mr. OLDENBURG presented a manuscript composed by Mr. JOHN WEBSTER, and dedicated to the Society, concerning *witchcraft*. The author's desire being, that the Society would give their sense of it, they appointed Sir WILLIAM PATTY, Dr. PELL, and Mr. MILLES, to peruse it, and report their opinion.

Dr. VOSSIUS's two Latin discourses were read; the one *De apparentibus in Luna Maculis*; the other *De speculo Archimædo*.

Mr. HOOKE gave his thoughts of both, saying, with respect to the former, that the author's opinion was very ingenious, but did not in all particulars seem to answer the phenomena. For though it should be granted, that a *lens* did so invert the object beyond it, as to make a protuberancy appear hollow, and the right side the left, & *vice versa*; and though we should grant, that there is such a propriety in the parts of the atmosphere of the moon, extended over and about the sides of the mountains, so as to be able to produce such an inversion; yet that would not suffice to make out the appearances: for in the coming on of the light and shadows upon those spots, which Dr. VOSSIUS esteemed mountains, but we believe cavities, the middlemost part of the spot being the most prominent is not first enlightened, as it ought to be, according to Dr. VOSSIUS's supposition; but the tops and sides of those circular ridges, that encompass the spot, and are next the sun, are so; and the shadow is, as it ought to be, cast regularly upon the other parts of the moon, according to the true rules of shadow: inasmuch that at the beginning the whole middle of the cavity is perfectly dark, as being overshadowed by the ridge of the sunny side: but as the sun rises higher, and enlightens the bottom of the cavity, one may in several of them discover, not only divers other lesser cavities or spots, incompass'd with ridges, as the greater, but also several small hills or hillocks, such as Dr. VOSSIUS would suppose inverted

* Register, vol. iv. p. 324. It is printed in Dr. GRÆW's *Comparative Anatomy of Plants*, book iii. by

That light is a vibrating or tremulous motion in the medium, (which is thence called pellucid) produced from a like motion in the luminous body, after the same manner as sound was then generally explained by a tremulous motion of the medium conveying sound, produced therein by a tremulous motion of the sounding body: and that, as there are produced in sounds several harmonies by proportionate vibrations, so there are produced in light several curious and pleasant colours, by the proportionate and harmonious motions of vibrations intermingled; and as those of the one are sensed by the ear, so those of the other are by the eye.

Mr. HOOKE intimating, that he had formerly brought in a paper concerning light, but not left it to be registered, he was desired to read it again at the next meeting.

He was also desired to have ready for the next meeting, the apparatus necessary for the making Mr. NEWTON's experiments formerly alledged by him, for evincing the truth of his new theory of light and colours, especially since Mr. FRANCIS LINUS had written another letter from Liege to Mr. OLDENBURG, dated 25th February, 1674, N. S., containing assertions directly opposite to those of Mr. NEWTON.

March 18. Mr. OLDENBURG read a letter to himself from Dr. BEAL, dated 8th March, 1674, concerning several sorts of cider grafts sent by him for the use of the Society; as also several curious stones.

It was ordered, that Mr. HOWARD, Mr. EVELYN, and Mr. PACKER be desired to take care of ingrafting these grafts.

Mr. OLDENBURG presented to the Society two books, one from Mr. BOYLE, concerning the *Possibility of the Resurrection*, containing many philosophical observations and experiments; the other the *Philosophical Transactions* for the year 1674.

Mr. HOOKE read a discourse of his concerning the nature and properties of light^a; in which were contained several new properties of light, not observed, that he knew of, by optical writers: and those were

1. That there is an inflection of light differing both from refraction and reflection, and seeming to depend upon the unequal density of the constituent parts of the ray, whereby the light is dispersed from the place of condensation, and rarified, or gradually diverged into a quadrant.

2. That this deflection is made towards the superficies of the opacous body perpendicularly.

^a Letter-book, vol. vii. p. 202. It is printed in the *Philosoph. Transact.* vol. x. n^o 121. p. 499. for January, 1683.

^b It is printed at the end of a discourse published

at London, 1675, in 8vo, intitled, *Some Considerations about the Reconcilableness of Reason and Religion.* By T. E. a layman.

^c See his posthumous works, p. 186—190.

3. That

3. That in this deflection of the rays, those parts of diverged radiation, that are deflected by the greatest angle from the frant or direct radiations, are faintest : those, that are deflected by the least, are the strongest.

4. That rays cutting each other, in one common foramen, do not make the angles *ad verticem* equal.

5. That colours may be made without refraction.

6. That the true bigness of the sun's diameter cannot be taken with common sights.

7. That the same rays of light falling upon the same point of the object will turn into all sorts of colours, only by the various inclination of the object.

8. That colours begin to appear, when two pulses of light are blended so very well, and near together, that the sense takes them for one.

1675. March 25. At a meeting of the COUNCIL were present,

The lord viscount Brouncker, president,	Mr. Hill,
Sir William Petty,	Mr. Oldenburg.
Dr. Whistler,	
Mr. Colwall,	

Dr. Whistler mentioned a proposal to be made to the council for disposing of Chelsea College.

He was desired to receive the proposal in writing for the next meeting of the council.

It was ordered, that the amanuensis and the operator should be urged to greater diligence and care in offering the printed bonds to those, who had not yet signed, between that and the next meeting of the council; and that they should desire every one of those, to whom they offered the bond, to give their positive answer, whether they would sign or not.

At a meeting of the SOCIETY on the same day.

Dr. GREW made a discourse concerning tastes, observing their differences, and drawing some corollaries from thence.

He was desired, both to give this discourse to be registered^a, and to print it.

It was particularly taken notice of, that Dr. GREW had in this discourse inti-

^a Register, vol. iv. p. 340.

It is printed in his *Anatomy of Plants*, p. 279, & seqq.

mated

mated, how the specifical virtues of plants might be discerned by their peculiar tastes.

Mr. HOOKER remarked, that all bodies dissolvable by the saliva are *tastable*, and consequently all bodies tasteless, that cannot be dissolved by the saliva.

He said farther, that any body, that is saporous, hath something peculiar in its structure, which gives it a peculiar taste; and that there is probably as great a variation in taste as there is in colours.

April 1. The SOCIETY did not sit.

April 3. At a meeting of the COUNCIL were present,

The lord viscount BROWCKER, president,	
The earl of Aylesbury,	Mr. COLWALL,
Sir JOHN BANKES,	Mr. OLDENBURG.
Dr. WHISTLER,	

One Mr. HOLMES offered, in the name of a friend of his, that if the council would let him have a lease of the house of Chelsea College for thirty years, he would lay out four hundred pounds in repairing that house, and pay five pounds a-year for the first fifteen years, and ten pound a-year for the remaining fifteen years.

He being asked, to what use it was to be employed, answered, that he had no authority from his principal to say any thing as to that. But the president replying, that the council was desirous to know that, before they proceeded in the treaty, and that it should go no farther than the council; he said, that he would acquaint his principal therewith.

The president mentioned, that the officers of the ordnance intended also to make an overture to the council concerning the same house.

Sir JOHN BANKES delivered the indenture concerning the fee-farm rents of twenty-four pounds per annum in Lewes in Suffex; which was delivered to Mr. COLWALL to keep.

At a meeting of the SOCIETY on the same day,

Sir ROBERT SOUTHWELL read his discourse concerning water, and promised to give it in to be registered¹, after he had written it fair. It was as follows:

“An excellent husbandman or gardener is able to raise a livelihood for his family out of a very little land; that is, out of about an acre to each head, as

¹ Register, vol. iv. p. 300.

" is seen in Holland and Zealand, and as is estimated to be in China : but one,
 " who hath no such skill, and who must live by gathering of such food as grows
 " wild, must range over perhaps a hundred times as much ground as the for-
 " mer, to procure a less splendid and commodious maintenance. In like man-
 " ner, those of our Society, who have been long versed in philosophical disquisi-
 " tions, can, out of some few circumstances of a single experiment, make such
 " an hour's discourse, as shall both profit and please their hearers : but I, who
 " have no such dexterity, am forced to take for my subject a whole element, a
 " quarter of the universe, and above half the surface of the habitable world, of
 " of which to pick up a coarse meal, wherewith to entertain this company ; and
 " therefore the matter of my present discourse shall be water.

" If there be four elements, I am content, that water should be one ; since
 " the forming of the world (as it is described by MOSES) doth countenance that
 " opinion ; since also many philosophers reach us, that every thing may be dis-
 " solved in *primam materiam liquidam* ; and since we see several herbs will grow
 " and contract to themselves a hard woody root out of water alone. But being
 " rather inclined to make but one common element, which is immutable atoms,
 " I am in the first place to conjecture, of what figures and motions those atoms
 " are, which do make and constitute water ; supposing, according to a late hypo-
 " thesis, that every atom (like the globe of the earth, like magnets, and indeed
 " the whole visible world) hath in it three points considerable, namely, two in their
 " surface, which were called poles, and one within their substance, which hath
 " been called bias, which biases have a tendency each to other, and to some com-
 " mon point without them.

The qualities of water are these :

- " 1^{mo}. Density ; for that it is not easily compressed into a narrower place at one
 " time than at another.
- " 2^{do}. Fluidity ; for that water poured out upon a level superficies diffuses it-
 " self also, almost into a physical superficies, or into a very broad body of little
 " thickness.
- " 3^{do}. It is hardenable into ice, and in being so hardened dilateth itself with a
 " vast strength.
- " 4^{to}. It is volatile ; that is, easily dissipated into invisible parts by heat.
- " 5^{to}. Small drops of water are disposed to form themselves into a globular
 " figure.
- " To solve all which phenomena, I humbly conceive, that the atoms, whereof
 " water is made, are globes or globular ; that their polar motions are but faint ;
 " that the motions of their biases one towards another are a little, but not much,
 " stronger ; and the tendencies of them towards the center of the earth, or spe-
 " cific gravity is not great.

" As for density, I conceive, that globes cannot, by any art of laying or packing them together, be stowed in less room one way than another; whereas even cubes, as they may be laid closer together than globes, so they may also be set edge-ways, and corner-ways, so as to admit many void spaces between them.

" As for fluidity, if a bag of globes, and another of cubical dyes, were poured out upon the like level tables, it is manifest, that the globes would run further, and lie less in heaps than the cubes, or than bodies of any other figure than globes.

" 3to. As for volatility, no bodies have less cohesion than globes, which can touch each other but in points.

" 4to. If glaciation or freezing be a fixing and staying of parts by wedges of nitre driven in amongst them, when the atmosphere is heavy; then it is plain, that no bodies will more easily admit wedges to be driven in amongst them than globes: and suppose, into a vessel full of globes an acute and long sharp angled wedge were driven, that vessel must needs dilate or break, with that force, which the ingress of wedges commonly maketh.

" 5to. Water hath no elasticity, because the motion of its poles is weak; for which reason also it doth not form itself spontaneously into any other figure than globes, because globes by apposition will make globes, but the globes, which water makes, are but small, because the motion of the biases are, according to our hypothesis, but weak, and such as their motions towards the center of the earth doth tear asunder, and hinder from conglomerating into very great globes.

" Having said thus much concerning the prime qualities of water from atomical principles and motion, we come next to the sensible differences between several waters, and to the ways of discerning between water and water, and between one liquor or fluid body and another, which are chiefly these.

" 1mo. Some water is heavier than others, viz. common water is heavier than spirit of wine, sea-water heavier than common water; and spirit of vitriol, salts, &c. heavier than sea water; and quick-silver the heaviest of all waters or liquid bodies.

" 2do. Some waters are more volatile than others; that is to say, more easily dissipable by heat, viz. quicksilver, though heavier than oil of vitriol, is yet more volatile than it, and spirit of wine is more volatile than saline spirits, in a far greater proportion than it is lighter.

" 3tio. Some waters, and commonly the lighter waters, are more impregnable with, and more susceptible of the matter steeped in them than others: so light waters

" waters do make better beer than heavier, perhaps because the light waters are
 " made of greater globes than the heavy and close waters, and consequently of
 " larger interspersed vacuities; that is to say, ampler receptacles for other inter-
 " venient matter. Moreover, we see, that waters are the best menstrua for im-
 " bibing the particles of other bodies; perhaps because water consisting of
 " globes is on all sides equally open, and fit for such admissions.

" 4to. Some waters dissolve more of the same salt than others, viz. more of
 " sugar, allum, vitriol, common salt, &c.

" 5to. Some waters are more absterive than others; that is to say, mingle
 " themselves more easily with saline, gummy, and unctuous substances than others;
 " for all sorts of fordes and absterienda are referrible to those heads, especially
 " such as are made of the effluvia of mens bodies, and which are washed off
 " from linen. Wherefore soap, or rather absterive liquors are made of saline
 " ashes of oils, and of gums or mucilages compounded together, for such a com-
 " position will absterge or cleanse almost every thing; for we see, that water joins
 " itself with slimes and mucilages; oils join themselves with grease; thin and hot
 " oils wash away thicker and cold oils; as spirit of turpentine washeth painters
 " colours; and acid liquors, as juice of lemons, washeth the vitriol of ink from
 " linen, and the liquor of tartar washeth away the blackness from ink itself.

" 6to. Some waters do harden the things, that are boiled in them, by stiffening
 " and restringing the parts of the same, and others soften and intenerate the matters
 " soaked in them.

" 7mo. Some waters coagulate milk, and cause separation of heterogeneous
 " parts more than others..

" 8vo. Some diaphanous waters, by mixtures, lose their transparency, and some
 " acquire colour without loss of their transparency.

" 9. Some waters are apt to putrify and to produce animalcula more than
 " others.

" 10. Some waters are apt to ferment and precipitate more than others.

" 11. Some waters are more sweet and nutritive.

" 12. Some waters promote the growth of plants more than others.

" 13. Fishes live and thrive better in some waters than in others, as some airs
 " do more favour the health of man than others.

" 14. Some waters break forth cold, some hot, out of the earth.

" 15. Some waters rise higher into clouds by the exhalation of the sun, than
 " others.

" 16. Some

- “ 16. Some waters are more diuretical and diaphoretical than others.
 “ 17. Some waters are more inflammable and spirituous than others.
 “ 18. Some are more stupifying, intoxicating, and inebriating than others.
 “ 19. Some are more apt to freeze, and the ice of some is more dense and uniform than that of others.
 “ 20. Some waters have their peculiar and specific qualities differing from others; of which (being infinite) I forbear to speak.

“ Having briefly touched upon the intrinsic constitution and sensible differences of waters, I shall next (perhaps with too great licentiousness) pass to the consideration of other difference and distinctions of water, more gross indeed, but not less useful in human affairs; to wit, I shall consider the waters of the world, as divided into sea and rivers, and the sea divided into coasts, shores, bays, roads, ports, havens, and creeks.

“ 2do. I shall, in some measure, divide the seas into the seas of several countries, as distinct from one another, and from the ocean; by which I mean the sea indifferently belonging to all countries and states.

“ As for the fresh waters, we shall divide them into lakes and rivers; and brooks and rivers into their heads, mouths, and sources:

“ For all these distinctions are of great use in political matters, if not in physical; and I hope you will suffer me, whose ordinary employment partakes more of the former than of the latter, to piece up my discourse of both; for without such license and encouragement I could not have appeared at all in this undertaking.

“ Wherefore I say, that water, viz. navigable water, is commonly divided into sea and rivers, or rather into inland and outland, as well as into fresh and salt-waters. Therefore supposing the sea did belong of right unto A, and the rivers unto B, it seems necessary, for the peace of mankind, that philosophers should assist the world, and particularly help A and B with such definitions, as are necessary for such their peace. In order whereunto I shall first premise the difficulties of that work itself; for although there be nothing more common than in talk to distinguish between seas and fresh water rivers, yet when we come to draw lines from one permanent and conspicuous mark of the one side of such waters, to the like mark on the other side of the same, I do not know, that there are any rules in nature for doing thereof, that is, such as may oblige the whole world. Nor are there so much as statutes and agreements of people for determining the same: nor hath ever the navigating nation of England set such marks, so much as on our own two greatest rivers, the Thames and the Severne. As for example, if we would distinguish the sea from rivers by canals,

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" 1^{mo}. We shall find no two tastes to agree upon that sign. 2. The salt waters of the sea intrude further upon the fresh rivers of the land at one time than another. 3. There may be both salt, or saltish rivers, and also fresh seas or lakes in the world, enough to disabie this means of a distinguishingment, especially when matters of great value and importance shall depend thereupon.

" Again, if we endeavour this distinction by the limits of ebbings, and flowings, accomplishing all waters, which have their reciprocal motion to be sea, 1. We shall find waters called seas, wherein those motions are very obscure and small. 2. Waters ebb and flow differently, according to wind and other accidents, besides their monthly and annual differences; besides those more slow changes, where the sea gains on one shore, and loses on the opposite.

" Lastly, if we would go about this work by narrowness or depth, we shall find very salt waters to pass through very narrow fretums, and salt waters to be very diffuse and fordable; and on the other hand, there are waters perfectly fresh, which be very broad and deep, besides the differences of passableness, which arise from the sides and bottoms of the water in question.

" Now, if we can find no rules in nature, but must fly to statutes, charters, and customs, the same can only oblige the few, which made and accepted them, not the whole world; and consequently cannot prevent wars and blood between the several nations, that find it their interest to contend about it.

" Moreover, as it is usual to talk of seas and rivers, as was distinguished, so Mare Hibernicum, Mare Britanicum, Mare Germanicum, frankly inserted; and our laws do make mention of things done inter or intra quatuor maria. We do also find mention of the Deucaledonian and Atlantic Oceans, &c. but it appears not by the consent of nations or princes. It is to be found on record remaining with all parties intended between each other, that there are permanent and conspicuous marks agreed upon on each side of the water, between which, as the terminus quo, and ad quem, where those lines of determinations should be drawn, viz. from what visible rock at Dover, to what like mark about Calais, the line may be drawn, which divides the Britain from the German Sea; from what point in Wales and Scotland, to what points in the fourth and north parts of Ireland respectively, the two lines shall be drawn, which, with the shores on each side, doth inclose the Mare Hibernicum. Much less do I find, what lines distinguish the British Sea from the Western Ocean, or the German from the Deucaledonian, &c. or, if such lines were fixed, can I conceive how, out of the sight of land, one could certainly know, when he is within or without them, so as to determine the controversy, whether a ship of an hundred thousand pounds value were prize or not, viz. if she were prize taken within, and not if taken without, the lines of fixed termination: for I can think but of three ways of doing the same, the first whereof is by latitudes and longitudes; the former whereof is not knowable at sea within less than about twenty English miles, and that too but when observations may be taken; and

“ and the latter is scarce knowable at all, otherwise than by running glasses, and
“ clocks, which do not yet go at sea sufficiently for that purpose.

“ The second way is by soundings, whereby the depth and nature of the ground
“ is discovered : but forasmuch as there may be plains in the bottom of the sea
“ of many miles in length, as also sudden and frequent inequalities in the same,
“ no certainty can be hoped for from that help.

“ The last is what men call the dead reckoning by rhombs and distances pro-
“ tracted on the card : but, forasmuch as no man can steer nearer than to half a
“ point ; (forasmuch as every ship's course is disturbed by tides, currents, and
“ leeward-way) forasmuch as the log and line is no certain measure of dis-
“ tances ; and for that the variation of the needle is to be observed in failing of
“ long runs in several parts of the world ; forasmuch as charts are not enough, or
“ equally true ; and lastly, for that a long reckoning shall, by its accumulation
“ of errors, differ much in truth from a short one : I say, for all these reasons,
“ the dead reckoning is not to be relied upon, where an hundred miles is in
“ question ; for either part will appeal to blood and blows, rather than acquiesce
“ in the finest conjectures, when such a wager lies at stake. It is true, such con-
“ troversies might be determined by the medium of the reckoning, made by
“ both parties ; or by the real and true reckoning of the superior party : but this
“ is not a rule in nature, but must depend upon conquest or consent.

“ We have said, that neither seas from rivers, seas from seas, nor seas from
“ oceans, can be distinguished by natural marks. We further say, that lands
“ from shores, and shores from coasts, are not distinguished by much more cer-
“ tain and satisfactory means : for, first, as for the shore, I take it to be ground
“ reciprocally shewing itself, and appearing both as land and sea, that is to say,
“ a girdle of ground comprehended between the high and low water marks of
“ an ebbing and flowing sea. Now, how this girdle straitens and widens itself
“ every day, by the interposition of winds and land-floods, by the new and full
“ moon, by the seasons of the year, by the firmness and looseness of the earth
“ upon the shore, and from some obtruse causes also, is well known to every ob-
“ server. Nevertheless, the limitation of shores is much more certain than that
“ of coasts, where certainty is more desirable and needful ; for I take a coast to
“ be that part of the sea without the low-water-mark to seaward, which by some
“ kind of natural right belongs to the paralleled and adjacent country washed by
“ it : as for example, our endeavour now is to answer the question, how many
“ miles broad is the coast of England, or of any part of it, viz. of Dorsetshire,
“ Devonshire, &c. ?

“ To which question I offer and propose the several following answers, viz.
“ 1. The coast of Dorsetshire extends from low-water-mark unto half the shortest
“ line between the shore of Dorsetshire and the shore of opposite France.

“ 2. It is the distance from the shore, where the convexity of the sea terminates the
“ sight of one, that standeth on the ground, or of an eye six feet above the ground,
“ 3. The

“ 3. The distance, at which the biggest ship (suppose of an hundred tons) can be seen from the shore.

“ 4. The distance, at which, from the tallest ship, the next land may be seen.

“ 5. The distance, unto which an open boat of certain dimensions dares ordinarily go a fishing into the sea.

“ 6. The distance from the shore into the sea, at which the best gun can carry or shoot with effect.

“ 7. The like distance, with respect to a musket, or the biggest killing instrument, that the strength of a man can wield or use.

“ 8. The distance, at which from sea a man, or other the biggest animal or thing, can be seen to move on the shore.

“ 9. The distance a man on horseback can ride from low-water-mark into the sea, and throw a dart, shoot an arrow, or bullet, out of such a gun as he can carry thither.

“ 10. The distance from the shore, until no ground can be struck by an ordinary deep sea-lead, suppose of an hundred fathom; all which distances and dimensions of a coast will be longer and shorter, according to several accidents and circumstances easily conceivable without further mention.

“ So what is meant by the shore or coast of France, upon which an Englishman may not fish without breach of peace, is unknown to me from any thing I ever yet read or heard discoursed, even by persons concerned as far as blood in those matters; and it is not yet clearly demonstrable, were the case put vice versa. I have met with a paper seeming to be a declaration, or intended declaration, from his late majesty of blessed memory, made in council, as I guess, between the years 1630, and 1640, wherein are these words, viz.

“ And therefore, to avoid all difficulties, and colour of controversies, that may be stirred concerning the bounds and extent, wherein his majesty now professeth to yield peace and security to his friends and neighbours desiring the same, his majesty purpeth to send plats of those limits to be affixed in the most public places of his chiefest sea towns and harbours, &c.

“ Now, in the maps and plats above-mentioned, I suppose the difficulties here lamented are remedied: wherefore I shall search for the same plats, and, if to be found, produce them; but if not, I shall then offer my thoughts to the same purpose.

“ I have here set forth the difficulties of distinguishing between navigable waters, as aforesaid: and now, by way of remedy, in case those directive pass, last

" last mentioned, intended at least to be set forth by the best skill and authority,
 " should not be found, I shall only offer, as an expedient for the present, the
 " following lemmas, viz.

" 1. That an enclosure may be made of those four seas, which are com-
 " monly deemed part and parcel of the English empire, by sensible and prac-
 " ticable marks, for an inconsiderable charge, viz. for within one hundredth part
 " of the yearly charge, which the sea forces of England have commonly cost,
 " and that so, as no vessel may go in and out of the same without notice, which,
 " in brief, is to say, that there is *mare clausibile*, if not *mare clausum* 177.

" 2. That it is for the advantage of all princes and states, who do pretend
 " to any share in the dominion of the seas to inclose, wholly to quit the same,
 " and transfer their whole pretences to some one of their number.

" 3. That the English Empire, besides their ancient rights by custom, con-
 " quest, and concessions, are the best qualified, even in nature, to receive and
 " administer this power; and that for the reasons following, which, because they
 " are natural, I here bring in, wholly declining the second lemma, as purely
 " political, and suspending the first till I find there is no better expedient already
 " extant; for, it being a matter of art, it might have fitted this presence well
 " enough.

" I say, the natural reasons for our sovereignty of the seas are these, viz. 1. Sup-
 " posing, for instance and illustration sake, the *mare clausum* we intend, to be the
 " seas comprehended within a line, beginning but even at the isle of Scilly, and
 " passing thence to Cape Clear in Ireland, thence to the Durfyes, and thence
 " again to the north-westernmost part of Ireland, thence by the Hebrides west-
 " ward to Scotland, thence to Cape Van Staten, then to the Naze of Norway,
 " thence to the next land of Jutland, thence to the Elb's mouth, thence by
 " Holland, Zealand, and Flanders, to Calais, thence to Heystant in Brittany, and
 " thence to Scilly where we began: I say, First, that the king of England hath
 " thrice as much shore, as the king of France, Spain, Denmark, the states of
 " Holland, with the towns of Hamburg, Embden, and Bremen, put all toge-
 " ther, do possess; and, though the Baltic Seas were added to the inclosure last
 " mentioned (the Sinus Bodicus excluded, lying without the latitude of Cape Van
 " Staten) the king would have as much shore as all the princes and states afore-
 " mentioned (adding the king of Sweden, with the elector of Brandenburg, the
 " towns of Lubeck and Dantick) also have: nay, if the Bay of Biscay were also
 " added as a third enclosure to the other two, the king of England hath still
 " more shore within all the said three enclosures taken as one, than any two of
 " the aforementioned princes, who have the most within the same: all which
 " may be seen by the maps.

2. The isles of Great Britain and Ireland do lie about the middle of the line of
 " trade, extending itself from Archangel in Russia, round about by Ireland to
 " Tangier, and through the whole Mediterranean Sea to Constantinople. More-
 " over,

“ over, Ireland stands in the face of the New American world, which doth al-
 “ ready, and will every day, more and more beget a vast trade; nor have France
 “ Spain, and Portugal, which also have the same aspect to the new world, half
 “ to many ports and conveniencies for the new world’s trade, as the king of
 “ England’s countries have.

“ 3. About three quarters of all ships of the several European nations trading
 “ to the East Indies, Guinea, the Streights, and America, must pass, in their
 “ voyages thither, between Scilly and Fleylant, or between Scotland and Nor-
 “ way; all which passages we supposed may be enclosed as aforesaid, and as shall
 “ hereafter be better explained. Moreover, the great magazine of naval provi-
 “ sions, as timber, plank, boards, iron, hemp, pitch, masts, and tar, as also of
 “ corn, must have vent through the same passages.

“ 4. The great fisheries of the old world, particularly that of herrings, (the
 “ Indies of the Hollanders) is within the chief of these three enclosures, and
 “ within the same is the greatest market and consumption of all the French
 “ bulky commodities, of wine, brandy, salt, paper, and their fruits. Moreover,
 “ against this enclosure are the greatest fisheries of the new world, namely about
 “ Newfoundland.

“ And, lastly, through the aforementioned passage must the Greenland and
 “ Muscovy trade be managed.

“ 5. The king of England and his subjects have already more shipping of war
 “ and trade, than any two of the princes aforementioned, the states of Holland
 “ only excepted, who have little other wealth: but he hath four times as many
 “ subjects as that state hath, who, when they find it their interest to look after the
 “ dominion of the seas, may also bear the same proportion to the Hollanders,
 “ even in naval strength also.

“ 6. It hath been shewn by a great observer, that the king of France is, or
 “ may be, superior to the king of Spain in naval force; but, withall, the king-
 “ dom of France is under natural and perpetual impediments of ever being as
 “ powerful at sea as either the English or Hollanders now are.

“ 7. The situation of Denmark and Sweden is such, in comparison of Great
 “ Britain and Ireland, with respect to this dominion, that the English can do
 “ more towards it with two, than they can do with four. Nor are the Danes and
 “ Swedes any thing as to this matter, unless they could be always as one, which
 “ the likeness of their interest will seldom suffer them to be.

“ 8. Great Britain and Ireland are under an absolute necessity to be strong in
 “ shipping and sea soldiers, to defend themselves from foreign invasion; which
 “ soldiers are also held best for suppressing any domestic insurrections amongst
 “ themselves. Now, sixty thousand men at sea is near treble the force, that ever
 “ any enemy appeared with against England, and yet may be maintained, with one

" one sixteenth part of the expence of the king of England's subjects : the raising of which one sixteenth part can be no sensible calamity upon his subjects, since few can discern the quantity and quality of the commodities they spend and use, within one sixteenth part of the same.

" Wherefore if, as it was before said, it be the interest of all princes and states, who have share and shore within these enclosures, to transfer their power to some one of their number, to prevent *bellum omnium contra omnes* concerning the same : And, since the king of England hath already so fair, so probable, and so ancient, a claim to this power, which neither he nor his subjects will ever quietly part with ; I conceive, that it is the interest of the said princes, for the additional natural arguments above mentioned, to resign and confirm the said power and authority unto him, without further trouble, and especially since his people, knowing their rights and interests therein, can otherwise, if occasion were, compel them thereunto.

" We have hitherto spoken of the differences of navigable waters : we shall in the next place pursue to define and distinguish some other particulars relating to the premises, as followeth : in order whereunto we next say, that

" A river is a channel, whereby fresh waters rising out of springs and collected rain waters, return into the sea constantly and continually : whereas brooks are not only small rivers, but rather channels, which run with waters, not constantly, but only at some times and seasons. The mouth of a river is the place, where the river joins with sea ; and the head of a river is sometimes taken for the smallest source and beginning of it ; but sometimes for some headland, ever without the mouth of the same : as for example, an head-land near Havre de Grace in France is called the Seine head. Nor is it incongruous to say, that the head and the mouth should be near, if not within, each other : whereas the beginning of that river and its head in some sense is many leagues southward of Paris. I mention this of names, because it is of great concernment in the settling of new colonies in America, the boundaries whereof are, for the most part, rivers ; and it is fit it be very clear what is meant by the head of river : as for example, there is now, or was very lately a controversy depending upon this very point, whereby the Bostoners in New England claim the provinces of Hampshire and Mayne to be under the jurisdiction of their province, while yet there are two distinct colonies and governments independent from Boston, according to the various acception of the word *head of a river* in the respective patents, whereby they are granted ; for, if the breadth of Boston province be the distance between the two parallels passing by the small inland beginnings of the two rivers, Charles and Merimac, then the three abovementioned province are but one.

" But if by *head* be meant certain points near the mouths of those two rivers, then are they three ; which is a vast difference, and toucheth estates, and might touch the lives of many concerned persons.

" An

" An haven or harbour must have those several following qualifications, viz.
 " 1. Stiff ground to hold anchors. 2. Free from rocks or sharp stones, which cumber
 " cables. 3. The ground soft and oozy. 4. Either water enough to ride aloft
 " at low water, or else the ground to be of easy declivity, that when a vessel
 " begins to ground upon the ebb, she may be soon fastened in shallower water,
 " and when a vessel floats upon the flood, she may be soon hauled out into deeper
 " water, to prevent knocking by the rising and falling of the sea waves; whence
 " it happens, that a ship becalmed on large flats, such as are between Gravesend
 " and the Downs, is in the same danger, as if she were taken with a storm; for
 " not being able to move forward, she must come aground in the ebb, and if the
 " sea grow when she comes to float again, she may be beaten to pieces, having
 " no deep water to be hauled into.

" 5. A harbour must have head-lands to break the violent influences of the sea,
 " with what wind soever they be forced in; and such an one is called landlocked.

" 6. The lands must not be so situate for height as to gather great quantities
 " or gusts of wind, called flaws, coming on a sudden.

" 7. The water must not be too deep, perhaps not above eight fathom; for
 " in such, the cable making an acute angle with the ground and surface of the
 " sea, prevents the vessel's head being pulled under water, as would be, where the
 " cable is more upright and perpendicular, and where the difference of the rising
 " of the sea is greatest.

" A creek is a small harbour, or harbour for smaller vessels.

" A port is an harbour so situate, as that ships may be protected within, and
 " into which none can pass in or out without leave of the land; and a place
 " within, which a small boat may go a shore at all times.

" A road is a kind of half harbour, where is good anchorage always, but not
 " protection from all winds at all times.

" What those districts and precincts of sea be, which are commonly called the
 " king's chambers, appear not to be publickly ascertained; but I guess them to
 " be a kind of segment of a circular space, where the land is the arch, and the
 " chord is a line drawn between two head-lands within ken of each other.

" The principal use of the sea and rivers is for easier carriage of commodities:
 " for we see, that a tun of twenty hundred of seacoal is brought near three
 " hundred miles for about four shillings; or at six shillings and six pence per
 " chaldre, which is in weight about thirty-three hundred; but the land-carriage
 " of the same by waggon would be about fifteen pounds, viz. seventy-five times
 " as much, and on horseback above an hundred times as much; horse-carriage
 " being in proportion to wheel-carriage as three to two: therefore, we may safely
 " say, that the carriage of coals from Newcastle by wheels would be infinitely
 " less

" sixty times dearer than the present sea-carriage; but the sea-carriage of coals
 " from London to the Land's-End of England would be treble of what the same
 " is from Newcastle, viz. about twenty shillings per ton, from whence, by the
 " way, may be noted, that the freight of shipping swells chiefly from their at-
 " tendances and waiting on their trade, not on the very value of the labour,
 " and when they neither stay for loading or unloading. Wherefore, more com-
 " monly and practically speaking, the ordinary proportion between ship and
 " wheel carriage is about one to twenty; and of inland water-carriage to wheel-
 " carriage, as one to twelve. Wherefore we may generally say, that land to
 " water-carriage is as about sixteen to one. Now, if the longest land carriage
 " in England do cost about three half-pence per pound, and the middle rate be
 " three farthings; and, that nine parts of ten of all goods imported and exported
 " is not worth four pence per pound, one with another, such as salts, wines,
 " corn, slaves, timber, board, fruits, iron, lead, &c. it follows, that the diffe-
 " rence between land and water-carriage is greater, than the gain, which any
 " merchant hopes to make; and thence it comes to pass, that the place, which is
 " most commodious for water-carriage, has vast advantages over all others for
 " gain by trade. And such a country is Holland, whereof no part is one quarter
 " of a mile from some navigable water, navigable at all times and by many
 " ways, viz. by coys or poles within board, by draught of men or horses from
 " the shore, by oars and sails, without the impediments of tides or currents,
 " land-floods, &c.

" From these considerations we come to frame a scale or measure, whereby to
 " determine, how much any country is better, one than another, for water-car-
 " riage, supposing, that all the inlands are rivered alike: and this is done by
 " determining how far any country, and all its parts at a medium, are distant
 " from the sea. In order to which, 1. compute the squares of a mile in side,
 " which the superficies of any country doth contain: next, compute the miles of
 " the perimeter shore belonging to the same: then dividing the squares of the
 " superficies by the miles of the shore, the quotient will give the breadth of the
 " oblong, or parallelogram, which the said country is equal unto in point of
 " adjacency to the sea; half which quotient, or breadth, is the middle distance
 " sought for: a collection of which distances will make a scale, wherein the con-
 " veniency of each country for carriage may be computed, according to which
 " scale, as I remember, France is eighty-six, England twenty-four, and Ireland
 " fifteen, miles distance from the sea.

" From hence also may be drawn another useful rule to know, of what ad-
 " vantage it is to plant or preserve timber in England or Ireland or any where
 " else; for, in Ireland, for example, the price of timber can be, 1. but fifteen
 " miles land-carriage, or ten shillings per ton. 2. Freight of the same from the
 " place, where it grows most plentifully, suppose Norway, which may be from
 " twelve to twenty more shillings, together with the wood-leave, hewing and put-
 " ting on board, which seldom, in woody shores, amounts to ten shillings more;
 " from whence it follows, that timber in Ireland will never be but about forty shil-
 " lings per ton, even although not a stick grew in the country; and consequently,

" this being known, one may compute, whether the lands and labour of Ireland
 " can be applied to more advantage of other kind, than by the planting and
 " culture of timber.

" These considerations force me to say something of navigable rivers, and of
 " making way for more inland water-carriage, upon which account I briefly say :

" 1. That a perch of river five feet deep, and about sixteen feet broad, may
 " be made at four pence per yard cube, for less than twenty shillings per perch,
 " where the ground is fit to hold water, and is not too contumacious by reason
 " of rocks and other impediments ; so that a mile of such excavation may be
 " had for about three hundred pounds.

" 2. That in most cases it were better and cheaper to make new channels of
 " just depths and breadths, than even to bank the rivers already in being, and to
 " repair all the inequalities of them, making use of the water of the old natu-
 " ral rivers, which is to be let into the new ones. And herunto we offer.

" 3. That these new channels need be no broader than that one boat may
 " pass, which may be, if, at every quarter or half mile's end, a small dock were
 " added to the side of the channel, into which, upon meeting of boats, which
 " cannot pass by side by side, one of them might put in till the other be past by ;
 " or, without these docks, the same thing may be performed by appointing
 " certain times for descending, and other like times for ascending, of boats
 " to pass.

" 4. Where the beginnings of rivers do lie higher one than another, or where
 " several rivers do rise out of one great mountain in the several heights of it,
 " there must be fitting contrivances to join them, other than the locks and sluices
 " now in use, which are impracticable, where the difference is above twenty feet,
 " or thereabouts : I say, provision may be made to comply with a difference of
 " about one hundred feet.

" 5. In order to the perfecting of this work, such contrivances must be had,
 " as to furnish any channels fit for the purpose, which of itself has no water at
 " all, with sufficient water from elsewhere.

" 6. A necessary preparation to this work is a map of the country, expressing,
 " not only the plain or level thereof, but also all the inequalities and diversities
 " of its surface as to figure and matter, with the mean quantity of water, which
 " is in every river of such country, and with the mean quantity, which passes
 " through it in an hour, or any other assigned space or time.

" 7. To know, whether navigabing of rivers would be a thing of profit, a
 " computation must be made, which is most easy, of the annual charge of land-
 " carriage to and from London, and between perhaps twenty other emporia of
 " the
 " Vol. III. E c

"the kingdom; as also an estimate of the numbers travelling to and fro between those places.

"8. There must be a law for purchasing all ground fit for this purpose at moderate rates, and for sending all malefactors not deserving death, and all idle persons, to this work.

"Having premised these eight particulars to encourage this work, I shall bring one computation, which, without the others above mentioned, is of itself sufficient to support this design; which computation consists of these following branches, viz. 1. That but one year of three is time of war. 2. That the intrinsic value of Newcastle coals is not above fifteen shillings per chaldron, under which rate, within these forty years, they have been bought and sold at London. 3. That in time of war they are at a medium sold for forty-five shillings a chaldron. 4. That about three hundred thousand chaldron are yearly brought into the port of London.

"From all which it follows, that London in the years of war pays four hundred and fifty thousand pounds extraordinary for coals, that is, the one third part of the same at a medium in times of war and peace, which is one hundred and fifty thousand pounds per annum. Now, if the purchasing of a perpetual convenience, worth one hundred and fifty thousand pounds per annum, be worth as many years purchase as land, the value of this convenience, at fifteen years purchase, is worth two millions and two hundred and fifty thousand pounds.

"Moreover it is certain, that there are coals somewhere within one hundred miles of London; and, if a navigable channel could be made, as aforesaid, between such place and London, at the rate of three hundred pounds per mile, then the purchase of this convenience would cost but thirty thousand pounds; or, if you please to comprehend all accidents, ten times as much, viz. three hundred thousand pounds: yet such charge is not the one seventh part of the two millions two hundred and fifty thousand pounds, above mentioned.

"The objection against this design is an opinion, that it is better for England and London to fetch coals from Newcastle, than to have them at Blackheath. Now, it becoming not this place to ramble too much out of the bounds of natural philosophy, I take the boldness to say, that such assertion is absurd, and infers, that it were better fetch cinnamon from the East Indies to heat our stoves in England, than to use furz or faggots for the same.

"To conclude this matter, I say, to the best of my understandings, that if one thousand miles of new navigable channels were made in fitting and passable places of England, the conveniences arising from the same could not cost three years purchase, besides the employing and punishing of all idle persons.

"I

" I say further, that, if this were done, the ports of England would be fewer
 " and better, and the kingdom more secure from invasion, and interruption of
 " trade, and also from the distractions and tumults, which may happen among
 " poor and mutinous people upon the want of commodities of necessity and
 " daily use. I am sensible, that what I have here said is rambling and extrava-
 " gant, and a sign of my want of natural philosophy. I shall now therefore
 " return, as well as I can, and give you my thoughts of a few other miscellany
 " matters relating to water, of which you are to expect no coherence.

" The first whereof is, that somewhere about Staffordshire is the highest
 " ground of England, and the place, as many do think, of greatest longevity.
 " That it is the latter, we must expect the proof from those scales of salubrity
 " and longevity not long since propounded by a member of this Society; and as
 " to the former, which is the highness of the land, it is visible from the in-
 " spection of any map of England; for therein it will appear, that Gloucester is
 " near of equal height with the sources of those rivers, which make the Thames;
 " and that Gloucester, situate towards the mouth of the Severn, is lower than
 " the sources of the Severn, which are in Staffordshire. 2. The sources of the
 " Humber and Trent are not far from the same place. 3. The rivers, which
 " run from about the same place into the Irish Seas, are short and swift, which
 " denotes the same assertion of the height of that place.

" The next of my Miscellanies shall be of land floods.

" We often find, that upon news of very ordinary rains, we withal hear now
 " and then of very great land-floods, where we little expect them; the reason
 " of which seemings wonder I take to be this; 1. Supposing rain or snow
 " (which is accumulate rain) to fall, not universally, but on some certain scope
 " or area of ground, suppose of four miles square, or of four miles diameter;
 " it is apparent, that, if this rain or snow fall upon a concave piece of ground
 " of that dimension, of the shape of a basin, or rather of a tunnel, having a vent
 " in its bottom, there must be a great flood, for that all the waters falling on
 " the whole must vent at some point-like place: whereas, if the same scope
 " of ground were a convex, the rain would fall and disperse itself every way,
 " and have a vent of twelve miles about, which, in the other case, was but a
 " point, or small scope, perhaps of a quarter of a mile. The two cases, which I
 " have put, are the two extremes of this notion; but as the shape of the land
 " partakes more of one or of the other of these extremes, so the effect will be.
 " Now, the sudden thaws of great accumulations of snow, joined with great
 " rains, is but a common cause of land-floods: but what I have here said is
 " intended to solve the anomalous appearing of land floods, besides expectation.

" And now, perhaps, it will not seem less wandering than the rest of this
 " discourse, if we get up into the air, and consider the way of birds over great
 " seas, which is the 3d of my Miscellanies.

“ 1. That birds do pass over great seas, and do readily and ordinarily find
 “ their way over them, is well known; nor is it doubted, that several birds,
 “ whose eyes are but the hundredth part in magnitude to the eye of a man or
 “ ox, can see much further than either; although we find, that long telescopes,
 “ and microscopes too, do best perform their several ends of vision.

“ 2. Birds, mounting themselves higher into the air, can best evade the im-
 “ pediments of sight, depending upon the convexity of the earth: yet I do not
 “ apprehend, how the betterness of their sight, or the highness of their prospect,
 “ should give them the advantages we admire, of finding their ways over seas
 “ of many kens broad, counting a ken to be about fifteen miles: I say, of so
 “ many kens as they can fly over, whilst they can want sleep, or such food and
 “ other necessities, as the land only affords them. Wherefore, stating the case,
 “ or supposing that birds can find their way over seas where they cannot see from
 “ shore to shore, the question is, by what marks they direct themselves?

“ In answer whereunto I first conclude, those marks are permanent; for other-
 “ wise they could not make use of them at certain seasons, and when the air
 “ through which they pass may be under great variety of winds and clouds.
 “ It cannot be by the sea water alone, for that is liable to much variety. I
 “ conclude therefore, that it must be by the ground or bottom of the sea ap-
 “ pearing through the water, and giving several colours to the same. For, first,
 “ it is manifest, that deep waters have not the same colours as shallow; sea water
 “ in a basin being without colour; but in its own proper place it is green.
 “ Secondly, Coloured water in a conical glass hath various apparitions between
 “ the base and vertex of the cone; that is, thick and thin bodies of water do not
 “ shew alike. Thirdly, The sea itself, when troubled and moved with sand, is
 “ not alike green, and all sea water has sand in it, for the white foam of the
 “ sea is small sand.

“ 4. As a coloured varnish spread over several-coloured grounds would shew
 “ of several colours, so also the sea water, which is such a varnish spread over the
 “ bottom of the sea, is of several colours, as the sands and weeds there are;
 “ and also their several distances from the surface will, and must, appear in se-
 “ veral colours. 5. Being within the body of a cloud, or mists, we see no dif-
 “ ference of colours; but beholding clouds at a distance, we discern variety
 “ enough of colour in them.

“ 6. Hewers, who give directions to pilchard fishers, standing on high places
 “ over the sea, do discern various colours in the sea, which the pilchards make;
 “ which colours are not discernable to the boats, which are amongst the pilchards,
 “ and at little distances from them.

“ 7. I myself have taken notice, that a shoal sea, looked upon from very high
 “ land, doth appear of different colours: from all which I infer, that the sea, seen
 “ from such heights, at which birds do usually fly, doth appear in several respects
 “ of distinct colours, of several shapes and dimensions; all which put together,
 “ are

" are as good marks as can be desired. Now it is likely, that in all weathers the colours are not wholly (though proportionably) alike, but in all times the shapes and dimensions appear the same, or at least in the same situation and regards one towards another, which is enough. For, if my direction be from a triangle in the east, to a square in the west, lying within ken asunder, it is no matter, whether their colours do now and then differ, or whether the corners of the triangle and the square do shew now a little sharper, and at another time somewhat blunter. It is sufficient, that I see a triangle, suppose half as big as the square, lying east and west from each other, and at about (suppose) three miles distance; for the distance and position will not alter, and the difference in figure and magnitude not very much: and, lastly, even the colour itself will change according to such rules as may be known. Wherefore I conclude, that birds crossing the sea have sufficient fixed marks for their direction.

" The fourth Miscellany is of the Mediterranean Sea.

" I remember, that long since I heard it agitated in this Society as an illustrious problem to give the reason, why the Euxine and ocean both running into the Mediterranean, as also many rivers, why the said sea doth not run over, and by what ways it doth empty itself of what it doth visibly receive. Before I advance further hereupon, I am to acquaint you, that one Mr. SHERRIS, who hath long served his majesty at Tangier, hath an elegant piece ready for the press concerning this subject, and that I had (though mediately) from him this fuller account of the phenomena following.

" 1. That the ocean runs into the Mediterranean at the Straits mouth about nine months in the year, viz. from February to November.

" 2. That the water of the Mediterranean runs backward into the ocean for one month in the year, viz. December, or about the winter solstice: that in November and January it ebbs and flows at the Strait's mouth about six foot.

" 3. That about the summer solstice, the current inward is so strong, as that a boat of ten oars can but well stem it.

" 4. That the Levant wind blows three most part of the summer, and that when that wind blows a storm outwards, there is a torrent inward of counter-moving water.

" 5. That there are but few and very small fresh rivers between the Nile and the Strait's mouth, nor any considerable one between the Strait's mouth and Cape Verd.

" 6. That the shore about the Mediterranean is bold and high land.

" 7. That the Mediterranean is in the middle of a vast continent, excepting on the west side where the ocean enters it.

" 8. Spouts

" 8. Spouts are more frequent here than in any other seas. From these eight phenomena he concludes, without subterraneous communication with the Caspian Lake, and without fancying that the water, which comes in at the top, goes out again at the bottom, he concludes, (I say) and I concur with him, 1. That the Mediterranean is exhale by the power of the summer sun exhaling its waters into vapours.

" 2. That those vapours are the Levant wind rushing outwards, as through the rostrum of a limbeck placed east and west.

" 3. That these exhalations fall down and condense without and beyond the mountains, which as lips encompass this sea; as appears by the paucity of rivers falling into it, and consequently this sea, raised in vapours, is carried into the ocean, where being condensed, it swells the said ocean, and from thence is sent back into its own sinus, with a strong current, because the passage is but narrow. Moreover, the exhalations aforementioned condensing beyond the said lips, do furnish water to many other rivers, which fall into the ocean, and thence back into the Mediterranean.

" 4. When no vapours are raised or sent out, as in December, the Mediterranean sets outwards; but when it doth neither set in or out, then the tides play their parts as elsewhere. Upon this occasion I put you in mind, that you were told by Mr. HENSHAW, that in the narrow of the Baltic, near Cronenburg and Copenhagen, the wind and seas, going the same way, do not violently oppose each other, as in the Mediterranean, where, as was said, a storm of wind outwards makes a torrent of water inwards.

" The fifth Miscellany is, of the getting or losing of the sea, and of bold shores.

" Where some winds are stronger than others, and blow more frequently, there the shores must change: as at Dublin, the westerly winds being far more frequent and strong, the water leaves the coast and impairs the harbour: and this predominancy and south-westerly winds in the channel between England and France may be a sufficient cause, why the shores are bolder, and ports more frequent, on the English than on the French coast.

" The sixth Miscellany relates to the saltness of the sea.

" The water of the sea is not salt, because the sun hath exhale the fresh water from it; for if thirty nine parts of forty of fresh water be evaporated, the remainder will not be salt as sea-water is: but supposing it were, then it must follow, that there is somewhere or other forty times as much fresh water as there is of salt-water in the sea; and this thirty-nine parts of forty of fresh-water must be somewhere between the sea and the sun. Now, if the sea in the deep,

" est place be three miles perpendicularly deep, we may suppose the sea, one
 " place with another, to be half a mile deep. Wherefore there must be a body of
 " fresh water about twenty miles thick covering the whole globe of the earth;
 " and if this water be in vapour, the sphere of vapours made of ten miles thick
 " of water must be some thousand miles thick; whereas there are no clouds ten
 " miles high. Wherefore this opinion is very absurd; for in no country of the
 " whole world does the fresh-water, which is visible, seem to be $\frac{1}{10}$ of the salt or
 " sea-water in and about the same. It is objected, that the sea is fresh below
 " the surface; but we deny the fact, as not confirmed by experiment, and against
 " reason; for salt-water being $\frac{1}{10}$ part heavier than fresh, will not swim upon
 " it; but the contrary: nor doth the crystalizing of salt in salt-pans in the top
 " of the great heat is, viz. in the top of the pans, according to the common
 " experiment, that the bottom of a boiling iron or brass-pot, taken off the fire,
 " may be safely touched with the flat of ones hand, whereas the top water will
 " scald vehemently.

" Wherefore, supposing sea-waters were created fresh or salt, it seems a more
 " natural question (because there is more salt than fresh-water) to suppose all
 " were salt, and then to enquire, how rivers and other shallow inland waters come
 " to be fresh, rather than supposing all waters to have been originally fresh,
 " to seek why the sea is salt; for that a little fresh water may be made out of much
 " salt-water is most obvious by rains and the common distillations.

" But if one would know, why the sea is salt, we must have recourse to some greater
 " body than the sea; that is, to the whole bulk of the earth, over part whereof the
 " deepest sea is but a varnish, the earth being above seven thousand miles thick;
 " and the sea no where three miles deep. Upon this method of enquiring, we
 " say, that every part of the earth contains salt of one kind or other; that every
 " plant yieldeth a fixt salt, not unlike common sea-salt. We know there be
 " salt-springs and brine-pits rising out of the earth, and that there be rocks of salt
 " in many places. Wherefore it is not to be wondered, if the waters, as well as
 " the earth, have their share of salt also; for as in sea-water about the forty or
 " fiftieth part is salt, to in many earths it is the same, and consequently a thing
 " not to be wondered at. That some seas may be saltier than others, may be
 " from the different quantities of subterraneous salt, which it meets with. That
 " fresh-water may be found in the bottom of salt-sea is more difficult to conceive,
 " since the saltier is heavier; but this is not difficult to him that considers, that
 " fresh waters may be shot by a fixt spring through water without much mix-
 " ture; nay, that fire may be shot through water without quenching; for a gre-
 " nado falling into a mill-pond has been seen to drive away all the water from
 " about it, and to burn for a little while as on dry ground. So a spring of fresh-
 " water, fed from a mountain much above the sea, may, like garden-fountains
 " supplied from cisterns on high turrets, boil up through a small body of salt-
 " water. Parallel herunto is the eruption of hot springs through cold waters,
 " which in many places have happened.

" The

" The seventh Miscellany is of tides and currents.

" That the surfaces of agitated waters are not true levels is plain from experiments of all sorts and sizes; for water moved in a trough is not so: and the waters in the canal of St. James's Park, when the wind blows hard right up and down the same, are visibly seen to accumulate on the leeward end; and when winds blow long into some capacious bays, then upon the ceasing of such winds, the water returning back towards its level makes a current, such as are often met with in navigations. Hence it comes to pass, that the tides rise higher at some places than at others; as, for example, in some of the sinuses in the west of Ireland, which have a near communication with the vast Western Ocean, there the tides are neither rapid, nor is the difference between the height of the water at full sea and low water much: but in the Severne, where the ocean comes in, as into the wide end of a horn, still straitning itself, there the tide runs stronger and stronger, and also the further it goes up with the land, and the difference between high and low water at the bottom of such indraughts, as at Chepstow bridge, is above thrice what is in those parts of Ireland above-mentioned.

" The eighth Miscellany is of the various course or running of tides.

" The last thing I shall trouble you with, is the reason of the seeming whimsical and disorderly motion of the waters at several states of the tides. That water should run or flow from north to south till half flood, and then quite contrary, as may be seen about Anglesey, where the sea comes in at one end of the island, but comes not in at the other end till it hath accumulated water enough to pass some mighty bank, but then comes in with such a violence, as doth repel the first more gentle motion of fewer and weaker waters. And what happens in diurnal tides, happens by parity of reason in neap and spring-tides: and this *luxus nature* is very great, and seems stupendous in some of the western islands of Scotland, as I have heard that memorable fellow and friend of this Society, Sir ROBERT MORAY, describe them.

" But there is nothing in this irregularity, which may not be mechanically explained, and even represented to the eye upon such figurations of the bottom and sides of the sea, as were not long since sent to this Society by the favour of prince RUPERT."

Mr. OLDENBURG read a letter to himself from Mr. HEVELIUS, dated at Dantzick, 25th March, 1675^a, concerning his observations of the last eclipse of the moon, 11th January, 1677, N. S.

April 15. A description of Mons. LEIBNITZ's watch was read, wherein was explained the principle of the exactness of the pocket-watches of his invention^b.

^a Letter-book, vol. vii. p. 133. It is printed in the Philosoph. Transact. vol. x. n.º 113. p. 289. for April, 1675.

^b Letter-book, vol. vii. p. 213. See Philosoph. Transact. vol. x. n.º 113. p. 285. & Journal Des Sçavans de 25 Mars, 1675.

His letter to Mr. OLDENBURG concerning it, dated at Paris, 30th March 1675. contained likewise his remarks on several algebraical subjects relating to Mr. JAMES GRAY, Mr. NEWTON, and Mr. COLLINS, together with the different sentiments of the Parisian astronomers concerning common and telescopic sights.

Mr. OLDENBURG read a letter to himself from Dr. BEAL, dated 31st March, 1675, concerning some advantages, that may be made by ingrafting in roots, as it had begun to be tried by Mr. LEWIS, for the speedy raising of an orchard and a grove, or a nursery of mulberry-trees, and for the alteration or mixture of vegetables: and how to make one tree or stock bear many, kinds differing in fruit, as apples, pears, nuts, grapes, plums, and cherries.

Mr. OLDENBURG read a paper in Latin, of Dr. VOSSIUS, containing some considerations upon Mr. HOOKE's animadversions on his former papers, concerning the spots of the moon and the Archimedean burning-glasses.

Mr. HOOKE remarked, that a good observer would see, that the tops and sides of the circular ridges, that surrounded the spots in the moon, are enlightened gradually, and not alike, and all together; which latter must be the case, if Dr. VOSSIUS's hypothesis were true.

He appealed to the members present, whether parabolical speculums were not better for burning than such flat ones, as Dr. VOSSIUS insisted upon.

Dr. VOSSIUS's paper was ordered to be registered.

April 22. Dr. WALLIS's printed discourse concerning gravity, read before the Society 12th November, 1674, was presented to it.

Mr. BOYLE's *Discourse concerning the mechanical production of Tastes* was read; wherein he proved by twelve experiments, that tastes may depend upon the size, figure, and motion of the saporous particles, and altered or destroyed according as those parts are by various conditions diversified.

These experiments were as follow:

1. To divide a body almost insipid into two bodies of very strong and very different tastes.
2. Of two bodies, the one highly acid and corrosive, and the other alkazitate and fiery, to produce a body almost insipid.
3. Of two bodies, the one extremely bitter, the other extremely salt, to make an insipid mixture.

" It does not appear in the Register.

4. Of two bodies, the one extremely sweet, and the other saltier than the strongest brine, to make an insipid mixture.

5. Of an insipid body, and a sour one, to make a substance more bitter than gall or aloes.

6. Of an insipid body, and highly corrosive one, to make a substance as sweet as sugar.

7. Of obtaining, without addition from the sweetest bodies, liquors corrosive enough to dissolve metals.

8. To divide a body bitter in the highest degree into two substances, the one extremely sour, and the other perfectly insipid.

9. To produce variety of tastes in one insipid body, by associating it with divers menstrua.

10. To produce variety of tastes with one menstruum by associating it with insipid bodies.

11. Of two liquors, the one highly corrosive, and the other very pungent, and not pleasant, to compose a body of a pleasant and aromatic taste.

12. To imitate by art, and sometimes even in minerals, the peculiar tastes of natural bodies, and even vegetables.

To this was added an excursion concerning some changes made of tastes by maturation.

It was ordered, that the hearty thanks of the Society be returned to the noble author of these experiments; and that he be desired to publish them^a.

Mr. Hooke was put in mind to make trials with the quadrant, for which the Society had been at near fifteen pounds expence.

April 29. Sir PHILIP PERCIVAL, Bart. was admitted a fellow.

Mr. EVELYN read part of his *Philosophical Discourse of Earth, relating to the Culture and Improvement of it for Vegetation and Propagation of Plants*, describing first, what he meant by earth; then enumerating the several sorts and kinds of earth; and, lastly, shewing how we may improve it to the uses of the husbandman, the tiller, and the gardener.

He gave, amongst other things, an account of the microscopical observations, which he had made of several sorts both of earth and dungs, to see, if by thus examining the several earths and soils, he might detect what rudiments of the principles of vegetation there were lurking in them abstractedly taken.

^a They are printed at London, 1676, in 8vo in his book intitled, *Experiments, Notes, &c. about the Mechanical Origin or Production of several particular Qualities, &c.*

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Having proceeded to that part, where he treats of stercoration, or manuring the ground by compost; and that subject being of such extent, as to require more time than was then remaining, he desired to defer it till another time, viz. the 13th of May.

April 30. The Council was summoned, but did not meet.

May 6. At a meeting of the Society

Mr. OLDENBURG presented several letters and papers lately come to his hands from his correspondents.

First, a letter from Mr. GREGORY, dated at Edinburgh 25th April, 1675*, giving an account of the inclinations and abilities of Sir GEORGE MACKENZIE of Tarbat for a philosophical correspondence; who had also sent several letters, containing observations of remarkable particulars in the Highlands of Scotland*, and promising more.

Secondly, a paper written by an anonymous author, containing a conjecture about the bladders of air, that are found in fishes, and the manner and organ, whereby fishes move to and fro in the water, from one depth to another*.

Thirdly, a description of a newly invented water-engine, which by the only weight of the falling water (without the force of man or beast, and without wind or wheels) shall raise as much water as you will, and to what height shall be desired; and requiring no more charges than the workmanship amounts to.

May 13. Mr. EVELYN continued to read his *Discourse of Earth*, and explained what advancement of fertility might be expected from stercoration and manuring the ground by composts. He enumerated, what composts may be had from animals, vegetables, &c. and intimated, that what seems most apparently to cause fertility is salt; yet without determining, that it is only salt or spirituous nitre, which produces that effect; and by inquiring into the several kinds of composts, and materials of improvement, he hinted the most genuine and true medicament of every soil for arable, pasture, or garden. He inserted a description of the best hot-bed, that he knew of: and after he had shewed, how to prepare, ripen, and apply the several composts, which are called the dry mixture, he described the liquid, and gave several considerable processes of that kind, useful to render the earth fertile, and to multiply grain.

He was thanked by the Society for this useful discourse, and desired to publish it after it had been registered*.

May 20. Dr. SIMPSON was proposed candidate by Sir WILLIAM PATTY.

* Letter book, vol. vii. p. 141.

* They are printed in the *Philosoph. Transact.*

vol. x. n.º 114. p. 377.

* This paper is printed in the *Philosoph. Transact.*, vol. v. p. 5. It was printed at London in 1676, in 8vo.

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There was read a discourse concerning the several motions of the seas and winds ; which was a translation of part of Dr. Vossius's Latin treatise, *De Motu Marinis & Venterum*, brought in by Mr. COLWALL.

The author was of opinion, that the sun between the tropics beating perpendicularly upon the seas, raises thereby the waters, and so causes a descent and motion from east to west ; which motion, he said, produces the variety of winds, and likewise of tides, according to the variety of coasts, with which it meets.

Some of the members reflecting upon this hypothesis, were of opinion, that though a hot body held over water would raise vapours from it ; yet it would not raise the water itself.

Mr. HOOKE produced his telescope, which being directed to the sun, rendered, by divers reflections, the beams of the sun so weak, that one might look upon the sun with as little inconvenience to the eye, as upon the moon.

May 27. Mr. OLDENBURG produced several relations, which he had received from his correspondents.

The first was from Mr. LOCKE, dated 20th May, 1675 *, giving an account of some fishes, that are poisonous, in New Providence, one of the Bahama islands ; which account had been sent to Mr. LOCKE from a friend in that island ; viz. that the fish, that are there, are many of them poisonous, causing a great pain in the joints of those who eat them ; yet do not kill any man, though they are fatal to cats and dogs : but with two or three days itching the pain in men wears off. It was added, that those of the same species, size, shape, colour, and taste, are some of them poisonous, others not the least hurtful ; and those, that are, only to some persons, and not to others : and farther, that those persons, who have been once distempered by them, have, upon the first eating even of wholesome fish, the poisonous ferment in their bodies revived thereby, and their pain increased.

The second paper was from captain RICHARD TAYLOR, commander of the ship Agnes and Grace, written 30th December, 1674, to Mr. BENJAMIN NEWLAND, merchant in London, concerning a sword-fish, that had struck his sword through a three inch plank of that ship, and thereby rendered it so leaky, that both the pumps could scarce keep her from sinking, &c.

The third was from Paris, 6th May, 1675, giving an account from Mons. LEMERY, how mercury effects salivation, viz. by uniting itself with the saline or acid ferment of the morbid matter, and so by being actuated with the heat of the bowels, passing to the head, and swelling it, and overspreading the inner part of the mouth with cancrs, that make the patient feel a pain like that, which would be felt, if some corrosive sublimate should excoriate some part of the body. Mons. LEMERY added, that the salival glandules of the mouth being pricked by

* Letter-book, vol. vii. p. 234. It is printed in the Philosoph. Transact. vol. x. n^o 114. p. 312.

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this sharpness are relaxed, and so come to salivate, which continues till the salivary vessels open. 221
has cleansed all the piquant salts, that kept the

This hypothesis was thought by some members unsatisfactory, because the mercury will cause salivation in found bodies likewise. Upon which it was questioned, whether to this mercurial salivation it be not always required, that the quicksilver be mixed with some saline particles or other?

Mr. Hooke promised to bring in his helioscope perfected; and likewise another experiment.

June 3. There was read out of the Register a discourse of Dr. JACKSON, a physician in Cheshire, giving an account of the salt springs of that country.

Mr. Hooke took occasion from the mention made in that discourse of an extraordinary hole, to relate, that he had been informed by a friend of his, living at Bristol, that near that city there was a hole of an extraordinary depth, in which at a great distance from the surface of the earth there ran a river, which being sounded was found of a vast depth. He said, that he was promised a more particular account of the observables of that place.

Dr. DANIEL COXE made mention of a mountain in Brasil described by PUCHAS, which the people can go into at a hole in one side, and come out at another hole on the other side.

Mr. Hooke related, that there was a place in Cheshire belonging to the lord BARRETON, where men having dug to a great depth for water to make salt with, but having met with none, lighted at last upon a stiff clay ground, which when they had bored into about five or six feet, the salt water from underneath the said bed of clay gushed out with such great violence, and in such a great quantity, as to fill the well, which was some hundreds of feet deep, to the top.

This gave occasion to speak of the origin of springs and rivers; several of the members being of opinion, that they were caused by rain and snow.

Sir JAMES LONG promised to communicate to the Society the observations, which he had made of the natural curiosities in Wiltshire, his own country, and particularly of the springs there, and the several forts of earths, especially of a fine azure earth near Chippenham in Wiltshire; as also of an extraordinary kind of periwinkle stones, shaped like screws; and likewise the several improvements of land made there.

Sir WILLIAM PETTY remarked, that it would be worth inquiring, where and in what grounds faintoin and clover-grass had succeeded best; and where it had failed most.

Sir JAMES LONG answered, that he knew one place near Chipping-Norton, called

called Hastings, which had made the greatest advantage by saintfoin of ay place he had heard of; and he had observed, that the said seed did not thrive in a good conditioned, but in a cold, stony, clay ground: but that, on the contrary, clover required a good barley ground.

June 10. Mr. OLDENBURG communicated an account sent to him from Paris concerning the origin of rivers¹; in which the author being of opinion, with many others, that rain and snow were sufficient to cause and to maintain them, had taken the pains for several years together, to observe the quantities of rain and snow, that had fallen, and reckoned them at a medium of about nineteen inches and $2\frac{1}{2}$ lines; and thereupon compared the quantity of such rain and snow with the quantity of water running away in rivers; having first laid down a way of measuring these two sorts of water, not leaving unconsidered the velocity of the running of rivers and the extent of the land, on which the rain and snow, serving for the supply of rivers, do fall. The result of which estimate of his was, that the rain and snow waters are abundantly sufficient to make rivers run continually.

Some of the members commended the attempt of this author.

Mr. HOOKE remarked, that the same had been performed and proposed to the Society many years before Sir CHRISTOPHER WREN, who, by the contrivance of a rain-bucket, had taken an account of the water, that fell for a long time together, and by his weather-clock had, among other particulars, not only taken in the measuring the quantity of rain, that fell, but also the time, when it fell, and how much at each time: which gave occasion to mention the important uses to be made of that instrument, if put into practice; since it was, by some additions made thereunto by Mr. HOOKE, adapted to record the weight of the air; the drought and moistures, the heat and cold, of the weather; the quarters and strength of the winds; the rain, sun-shine, &c. and all this to be performed by one motion, driving all the parts of the instrument; which was the more considerable, for that itself records its own effects.

June 17. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
Sir JOHN LOWTHER,	Mr. COLWALL,
Sir JOHN BANKES,	Mr. HILL,
Sir ROBERT SOUTHWELL,	Mr. OLDENBURG.

It was ordered, that a treatise intitled, *Francisci Willughbbei de Middleton Armerigi; quondam e Societate Regia, Ornithologia*, be printed by JOHN MARTYN, printer to the Society: And,

That a discourse made before the Society the 29th of April and 13th of May

¹ See Philof. Transact. vol. x. n^o 119. P. 447. for November, 1675.

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 last, by JOHN EVELYN, Esq; concerning the improvement of earth for vegeta-
 tion, be printed likewise by the said JOHN MARTYN: And,

That a treatise, intituled, *Marcelli Malpighii Philosophi & Medici, & Societatis
 Regiæ, Anatome Plantarum: cui subiungitur Appendix repetitis ab eodem Auctore de
 Formatione Pulli in Ovo Observationes continens*, be printed by the said JOHN
 MARTYN.

At a meeting of the SOCIETY on the same day,

Dr. JOHN FRANCIS PREISS, physician of the prince of Newburg, was proposed
 candidate by the earl marshal of England.

Dr. GREW brought in and read his discourse concerning the trunks of plants,
 which he divided into seven parts;

1. Of the motion of the sap in such trunks.
2. Of the motion and course of the air in them.
3. Of the generation and structure of the parts of a trunk.
4. Of the generation of liquors contained in them.
5. Of the several figurations of trunks.
6. Of the motion of trunks upwards, downwards, sideways.
7. Of the several qualities, whereby trunks are fitted to divers mechanical uses.

Dr. GREW had the thanks of the Society given him for this discourse, and was
 desired to give it to be registered, and to publish it.

Sir WILLIAM PETTY took occasion from this discourse to propose it to con-
 sideration, what might be deduced from the discourse read for explaining the cause
 of the warping of wood; concerning which Mr. HOOKE said, that there was a
 fermentation in the liquors of wood, which required a considerable time to do its
 work, which was by making the liquors work upon one another, to separate the
 moisture, without which there was no fermentation; and which being driven out,
 the wood was then seasoned, and so warped not; so that by destroying the fer-
 mentative principle, the wood was preserved, and made to retain its figure, and
 so kept from warping.

The ascension of sap in trees being also spoken of, there were mentioned sever-
 al opinions concerning it. Dr. GREW alledged his opinion, delivered in the
 discourse. Mr. HENSHAW said, that he thought the sun by force of its heat

^a It does not appear in the Register.

^b It is printed at London, 1676, in 8vo under

the title of *The Comparative Anatomy of the Trunks
 of Plants, &c.* thrust

thrust up the moisture of the ground into the roots of vegetables; and that being got up a little way, the night and cold coming on made it stop, till the sun's heat of the next day returning drove up more moisture; which being crouded in must needs force up the moisture, that there was there before; and so on from day to day, till it came up to the top, and all the parts of the plant.

Mr. Hooke added, that it was worth a more particular inquiry, whether there were not valves, or something analogous to them, in vegetables.

Dr. GREW said, that he had hitherto observed no such thing as valves in the sap-vessels of plants.

Mr. OLDENBURG mentioned, that Signor MALPIGHI had explained this phenomenon of the rising of sap after the manner, that Mr. HENSHAW had discoursed of it; and that the same author, in his discourse of the anatomy of vegetables, dedicated to the Society, had taken notice of something like valves in plants.

June 24. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,	
The lord bishop of Salisbury,	Mr. HOSKYNs,
Sir JOHN BANKES,	Mr. OLDENBURG.
Mr. HILL,	

Mr. WILLUGHBY's *Ornithologia*, Mr. EVELYN's late discourse on agriculture, and signor MALPIGHI's *Anatome plantarum*, were licensed.

The council considering of the persons, who deserved to be expelled, thought fit to begin with the following:

Dr. LOWER,	Mr. WALLER,
Dr. DOWNES,	Mr. SLINGSBY.
Sir EDWARD BYSSHE,	

Sir JOHN BANKES reported, that the committee of the East India company had given order to empty the west gallery in Gresham College, and to deliver it again to the Mercers company, from whom they had received it.

At a meeting of the SOCIETY on the same day,

Mr. Hooke produced again his helioscope, which had three reflections; the first reflecting the fifth, the second the twenty-fifth, and the third the hundred and twenty-fifth part of the direct light of the sun to the eye.

It being asked, whether by it he had observed any spots in the sun, he answered, that at present there were none, that he could see.

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Mr. OLDENBURG brought in several earths sent him by Dr. Plot from Oxford, which the said doctor had met with in his survey of that shire, but knew not their names; which therefore he desired might be sent him from hence, he being then about digesting and printing his observations made of Oxfordshire.

The particulars being viewed, it was thought fit, that Dr. Plot should be desired to send greater quantities of them, and to add the several places, where they were found, and the beds, wherein they lay; whereupon they might be better examined, and their names returned with more certainty.

Mr. OLDENBURG communicated a letter to himself from Mr. GREGORY, dated at Edinburgh, 8th June, 1675, describing a way of his to prove the motion of the earth, different from that of Mr. HOOKE published some time before; as also assigning the limits of a biquadrate equation by the roots of a quadratic equation.

Mr. GREGORY's letter is as follows:

" Sir,

" By M. COLLINS his favour I have seen M. HOOKE'S excellent treatise for proving the motion of the earth; and have had some thoughts thereon, which perchance, if not too obvious, and already known to you, may be of some consequence. Let CD be two fixed stars; S the sun; $CDBA$ a plain going through the three points CDS , and cutting the orbs of the earth in A and B ; let a circle pass through the points A C D , cutting CB in E ; the sine of the angle CAD is to the sine of the angle CB as BE to DE ; which proportion may be pretty sensible, if the star D be much nearer than C ; yea, sometimes perchance so sensible, that D may from B seem on the one side of C , and from A on the other. The points A B in the orbs of the earth may be with ease found out more precisely than is required for this business. My thoughts briefly are these; if from A and B the angles CAD , CB , BD be observed and found unequal, from thence two things may be inferred, hitherto questioned, viz. the motion of the earth, and the unequal distance of the fixed stars. Secondly, these angles (as to the inequality, if such thing be) may be observed easily, because any two stars in the firmament, if they fall within one view of the telescope, may be chosen for this effect; one of which may be a large star of the first magnitude, and consequently by all probability near to us; and the other of the sixth, yea, perchance of the sixtieth magnitude, and far from us; and which is most of all this, without any considerable preparation, may be easily and exactly observed by any sort of micrometer; or if D be seen on both sides



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Letter book, vol. vii. p. 241.

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" of C, which may sometimes fall out) with a simple telescope. If it be observed, that from this only can be gathered, that the fixed stars have parallax, and not how much it is in this or that star, albeit the main business be to prove they have parallax: yet from a third observation, as suppose at F, may be gathered geometrically the parallax of both C and D, if that be esteemed *opere pretium*.

" I lately received a letter from M. COLLINS; he desires therein the limits of a biquadratic æquation by the rules of a quadratic æquation, which is as follows: let the æquation be (seeing always the second term can be taken away)

" $\times 4 - p 2 \times 2 + q 3 \times - r 4 = 0$; and let $x = \frac{t^2}{3}$; the former æquation becomes

" $z 4 - \frac{q 3 t^2 z^2}{r 4} + \frac{p 2 t 4}{r 4} z 2 - \frac{\times 8}{r 4} = 0$: the limits of this biquadratic æquation are

" so determined; (and to this former all biquadratic æquations can be reduced after this manner.) Let the curve for this æquation be F A D E G, whose maxima and minima are A D E; for always in this case one of the limits falls in A, the beginning of the reckoning.

" Let ordinates from the limits be D B C E

" the points B C are so determined: multiply the terms of the last æquation in their

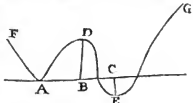
" exponents, and it becomes $z 2 - \frac{3 q \times 2}{4 r 4}$

" $z + \frac{p 2 + 4}{2 r 4} = 0$; here z is found, which

" in this present æquation is A B or A C,

" viz: $z = \frac{\pm \sqrt{3 q 9 6 t 4 - 3 2 p 2 t 4 r 4 + 3 q 3 t 2}}{8 \sqrt{4}}$, all this time t is undetermined,

" for it may be put ad libitum; which shews that this may be done infinite several ways."



Mr. HOOKE said, that he had made mention of this way likewise in his printed book; which he was desired to shew.

Mr. OLDENBURG produced a printed scheme sent him from Paris concerning a pear, that had brought forth another little pear at and through the head of it, and at the top of it some leaves; which fruit having been opened at Paris longways, and cut through in the middle, there was no core nor kernel found in it, but it had firm pulp throughout; and the ligneous fibres, which the stalk uses to emit in the place, where it sticks in the pulp, continued to pass on through the whole middle of the pear, and so produced the small branch and leaves above-mentioned. Besides which it had been observed, that the pulp of the mother-pear was separate from the pulp of the other infant-pear, which was not quite come out, but still stuck fast in the head of the mother-pear.

June 28. At a meeting of the COUNCIL were present

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The lord bishop of Salisbury, vice-president, in the chair,
 Sir JOHN LOWTHER,
 Mr. WILLIAM PETTY,
 Mr. HENSHAW,
 Dr. WHISTLER,
 Mr. COLWALL,
 Mr. HILL,
 Mr. OLDENBURG.

Inquiry being made, whether the west gallery in Gresham College was emptied, it being found not to be so yet, Mr. Hooke was ordered to call upon the officers of the East India company to remove their goods, according to the order of the committee of the said company.

It was ordered, that the amanuensis do from the council attend Mr. NELTHORPE, and demand the arrears of his quarterly payments due to the Society at Midsummer preceding, amounting to fourteen pounds nineteen shillings; acquainting him with the order, that whoever of the Society shall refuse to pay their arrears due by their subscriptions at their admission into the Society, shall be proceeded against according to statute.

July 1. At a meeting of the Society.

There were read several letters.

1. From Mr. FLAMSTEAD to Sir JONAS MOORE in Latin *, containing his observations on the eclipse of the Moon, 26th June, 1675.

2. From Mr. RAY to Mr. OLDENBURG, dated at Middleton, 26th June, 1675 *, concerning the use of the swimming bladders in fishes, viz. to sustain or keep them up in any depth of water: since, as it had been experimented, if the swimming bladder of any fish be pricked or broken, such a fish sinks presently to the bottom, and can neither support nor raise itself in the water.

3. From Mr. LISTER to Mr. OLDENBURG, dated at York, 27th June, 1675 *, containing some observations sent him by Dr. THOMAS TOWNE from Barbadoes about the temper of the air in that island, divers European plants growing there as well as in England; all springs being there near the sea; the blood of negroes being as black as their skin, &c.

4. From Signor MALPIGHI to Mr. OLDENBURG, dated at Bologna, 17th June, 1675, acquainting the Society with his endeavours of observing and delineating the structure of the galls of trees, &c.

July 8. Mr. Hooke shewed an experiment concerning the resistance of air to a ball moved with and without an expanded area; of which he was desired to bring in a particular account in writing.

* Letter book, vol. x. p. 252. It is printed in the Philosoph. Transact. vol. x. n^o. 216, p. 371.
 * Letter-book, vol. vii. p. 252. It is printed

in the Philosoph. Transact. n^o. 112, p. 340.
 * Letter book, vol. vii. p. 216. It is printed in the Philos. Transact. vol. x. n^o. 117, p. 399. The
 G E 1.

The Society was adjourned this day till the president should think fit to summon them to meet again.

October 21. At a meeting of the COUNCIL were present,

The lord viscount Brouncker, president,	
Sir JOHN LOWTHER,	Mr. HILL,
Sir JOHN BANKES,	Mr. OLDENBURG.
Mr. COLWALL,	

It was ordered, that the following persons be sent to for their positive answer, whether they would sign the bond or not, viz.

Dr. AGLIONBY,	Mr. LAKE,
Sir CHARLES BERKLEY,	Dr. DU MOULIN,
Dr. BRUCE,	Sir THOMAS NOTTE,
Mr. CARKESS,	Mr. SOAME,
Sir WINSTON CHURCHILL,	Mr. STANLEY,
Col. COLSEPPER.	Mr. WYNDE.
Sir RICHARD CORBET,	Mr. WOODFORD,
Mr. CURTHOPE,	Mr. WOODROFF,
Sir FRANCIS FANE,	Dr. WREN.
Mr. HAMMOND,	

And it was thought fit, that those, who were deep in arrears, and gave no hope of being of use to the Society, should be all expelled.

It was ordered, that the Society should be summoned to meet again on the 28th of October;

That MICHAEL WICKS do attend Sir JOHN BANKES the next day at the East India House to receive the order for clearing the west gallery in Gresham-College: And,

That Dr. GREW's book, intitled, *The Comparative Anatomy of Trunks, together with an Account of the Vegetation of Trunks grounded thereupon, in two parts, the former read before the Royal Society, February 25, 1674, the latter June 17, 1675, the whole explicated by several figures in nineteen copper-plates, presented to the Royal Society in the year 1673, and 1674,* be printed for WALTER KETTLBY by the assignee of JOHN MARTYN, printer to the Royal Society.

October 28. The Society returned to their weekly meetings.

Dr. GREW read a lecture concerning the nervous liquor, its origin, nature, motion, and uses in the body; as also the symptoms and distempers arising from it, when disordered or vitiated.

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He was desired to leave it to be registered, and to publish it.

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Mr. OLDENBURG communicated two letters to himself: one was from JOHN CRUZADO, professor of the mathematics at Seville in Spain, dated there 20th August, 1675⁶; in which was proposed a new place for the first meridian, which is a little island called *Abreros* lying under the very equinoctial near Brazil; in which island there is said to be no inequality at all in the natural days. The writer of this letter likewise asserts a method of knowing the true place of the moon.

It was ordered, that he should be thanked for his communications, and acquainted, that the Society did not dislike the place assigned by him for the first meridian; but that they could not assent to his assertion concerning the equality of all natural days, nor to that which related to the method of knowing the true place of the moon.

The other letter was from Signor TRAVAGINO, dated at Venice, 16th June, 1675⁷, containing a description of a way used to fix quicksilver into silver; together with a piece of the metal thus fixed; which was produced before the Society, and there cut through to see how it looked in the middle, where it appeared as white as on the outside.

Mr. OLDENBURG related, that he had given some of it to Mr. BOYLE, to try it, who had assured him, that having tried it in a coppel, it had endured that trial as well as silver doth: but he having weighed it in water, it proved not so ponderous as silver, but wanted somewhat of the weight of tin. So that this seemed to be a new metal, having the whiteness, malleableness, and fixity of silver, but not the weight thereof.

It was desired, that a little of it might be given to the assay-masters of the mint for farther confirmation.

November 4. Mr. OLDENBURG produced a box, containing divers minerals sent from Oxford by Dr. ROBERT PLOT, who intended to compose a natural history of all England; of which particulars he desired to know the names and uses. The chief of them were, 1. Some earths resembling bolus's and terra figillata. 2. Some stone, thought to contain *lapis calaminaris*. 3. Some slate, like mundick. 4. A substance like alabaſter, which might, it was thought, be very fit to make good mortar of. 5. Some fine powders, taken out of the veins of the earth. These and some others were found under ground in Oxfordshire.

Mr. HOOKE read a lecture, wherein he explained a mechanical contrivance to supply the pabulum of a lamp in the same degree it is consumed, or to keep the

* It does not appear in the Register.
 a Letter-bk. sk. vol. vi. p. 272. It is printed in the Philosoph. Transact. vol. x. n^o 118 p. 425.
 b Mr. Oldenburg's answer to CRUZADO.

dated 15th September, 1675, is inserted in the Letter-book, vol. vi. p. 270. and printed in the Philosoph. Transact. vol. x. n^o 118. p. 419.
 c Letter book, vol. vi. p. 245. surface

surface of any liquor, fit to feed the flame of a lamp, always at the same high, till all be wasted.

Having both described and delivered one way of performing this, he promised to bring in divers other ways of effecting the same thing.

November 11. At a meeting of the COUNCIL were present,

The lord viscount Brouncker, president,	
Dr. WHISTLER,	Mr. HILL,
Mr. COLWALL,	Mr. OLDENBURG.

A committee was appointed for auditing the treasurer's accounts, consisting of the president, Dr. WHISTLER, Mr. HILL, Mr. HOSKYNs, and Mr. OLDENBURG; three of whom were to be a quorum.

It was ordered, that the council be summoned to meet again on the Thursday following November 18, at twelve at noon.

At a meeting of the SOCIETY on the same day,

Dr. GREW gave an account of that Substance, which Mr. HOARE had put into Mr. OLDENBURG's hands for examination; which seemed to be petrified wood. He said, that he had viewed it with a microscope, and found it to have been a piece of birch-wood, now perfectly stone, having three or four rings in it, the vestigia of its former constitution.

Mr. OLDENBURG presented to the Society from the printer a description of the islands and inhabitants of Ferre, &c. written in Danish by Lucas Jacobson Deber, M. A. and preposit of the churches there: Englished by J. S. doctur of physic: Printed in 1675, in 12mo.

A letter in French to Mr. OLDENBURG by Monsr. JOLY of Dijon, dated there, 28 September, 1675¹, was read; in which he offered to communicate his meditations upon the nature of motion, if the Society did not think that subject altogether exhausted by Sir CHRISTOPHER WREN, Dr. WALLIS, and Monsr. HUYGENS.

The Society declared, that though those persons had written very well upon that subject, yet the meditations and labours of others would still find place; and that therefore Monsr. JOLY should be desired to prosecute and finish his thoughts upon so important a subject.

The earl marshal remarked, that he had in some land of his near Scotland a Graylock a river running from a mountain, reported to contain copper mines, out of which the cattle drinking got their teeth brazed over; as appeared from

¹ Letter-book, vol. vii. p. 157.

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some of oxen and cows produced by his lordship, and left them for the repository, which teeth had a kind of copper-colour superinduced upon them.

Some of the members desired, that some of the cattle, which had drunk a while of that water, might be opened, to see whether any thing remarkable appeared within their bodies.

Mr. Hooke read another lecture about divers ways of keeping the pabulum of a lamp always at the same height with the bottom of the flame thereof, till all the liquor be consumed. Of these methods he explained seven or eight more.

November 18. At a meeting of the Council were present

The lord viscount Brouncker, president.	
Sir JOHN BANKES,	Mr. HOSKYNs,
Mr. HENSHAW,	Mr. HILL,
Mr. COLWALL,	Mr. OLDENBURG.
Dr. WHISTLER,	

It was ordered, that the following persons be left out of the list to be printed for the approaching election-day, viz.

Dr. BRUCE,
Mr. CARRESSE,
Col. COLEPEPPER,
Dr. DOWNS,

Dr. LOWER,
Sir THOMAS NOTTE,
Mr. SLINGSBY,
Sir PETER PETT.

The reason of omitting them was their not performing their obligation to the Society.

It was ordered, that the salary of the curator be not paid for the future by the treasurer but by special order of the council.

At a meeting of the Society on the same day,

A committee was chosen by ballot for auditing the treasurer's accounts, consisting of

Sir ROBERT REDDING,
Mr. BARRINGTON,
Dr. CROUNE,

Mr. HAAR.
Mr. HOOKE.

Three of these to be a quorum, and to meet as soon as the committee of the council had made their report to the council concerning the state of the last accounts.

Mr. OLDENBURG read an account of some experiments made in the air-pump by

by Mons. PAPIN, directed by Mons. HUYGENS. They were several mixtures of divers liquors, as aqua fortis and spirit of wine, aqua vitæ and spirit of wine, common water and aqua vitæ, to see what ebullitions they made *in vacuo*; and whether these ebullitions made new air; and the difference of the air formed by the mixture of aqua fortis and copper from that which was produced by the mixture of oil of tartar and oil of vitriol, of which two mixtures the former yielded an air always remaining, the latter not so.

Besides these, there was an account of an experiment of a mixture of aqua fortis and aqua vitæ with bits of iron in it, some of which was put *in vacuo*, some not, together with the different effects of both. Likewise experiments with oil of olives with vinegar and with spirit of wine, also with water and lime, and with plaister of Paris flaked *in vacuo*; together with the considerable different effects of them *in vacuo*, and in the open air.

Mr. OLDENBURG was desired to take care of entering these experiments in the Register^a, and, if he had any more of that nature, to impart them.

It was ordered, that the exhauiling engine should be put in order, for making more experiments in it; which was chiefly urged by Dr. CROUNE, who said, that he intended to make some trials therein.

Mr. OLDENBURG communicated Mr. NEWTON's answer, dated at Cambridge, 13th November, 1673^b, to Mr. LINUS's letter to Mr. OLDENBURG from Liege, 25th February, 1674, N. S.^c, concerning an experiment relating to Mr. NEWTON's new theory of light and colours; which imports, that the experiment contested was made in a clear day; and that the prism therein employed was placed close to the hole; and that the coloured image was not parallel to the axis of the prism, but transverse to it: which three particulars being contradicted by Mr. LINUS, Mr. NEWTON, in this letter, directs his antagonist again very punctually, in what manner to try the experiment, to satisfy himself about his veracity in relating the same.

Mr. NEWTON offering, in the same letter, to send to the Society a discourse of his about colours, when it should be thought convenient, Mr. OLDENBURG was ordered to thank him for that offer, and to desire him to send the said discourse as soon as he pleased.

November 25. At a meeting of the COUNCIL were present

The lord viscount BRAUNCKER, president,
The earl of Aylebury,
The lord bishop of Salisbury,
Sir JOHN LOWTHER,
Sir ROBERT SOUTHWELL,

^a They do not agree there, but are printed in the Philosoph. Transf. vol. x. n° 119 p. 43. for November, 1675.

^b Letter-book, vol. vii. p. 175. It is printed in

the Philosoph. Transf. vol. x. n° 121. p. 500.
^c Letter-book, vol. vii. p. 202. It is printed in the Philosoph. Transf. n° 121. p. 492.

Mr,

Mr. HENSHAW,
Mr. COLWALL,
Dr. WHISTLER,

Mr. HILL,
Mr. HOSKYNES,
Mr. OLDENBURG.

It was ordered, that the president or his deputy be desired to intimate to the Society on their approaching anniversary election-day, that they could not but take notice of some persons left out of the list: that this was done, because they were found not to have performed their obligation to the Society: and that therefore the council intended to proceed against them according to statute: and that the names of those persons should be then publicly read, viz.

Dr. BRUCE,
Mr. CARKESS,
Col. COLEPEPPER,
Dr. DOWNES,

Dr. LOWER,
Sir THO. NOTTE,
Mr. SLINGSBY,
Sir PETER PETT.

It was ordered also, that the president be desired to give directions to the treasurer, for demanding and receiving the rent of the twenty-four pounds due for the four hundred pounds legacy of the late Dr. WILKINS, bishop of Chester.

At a meeting of the SOCIETY on the same day.

Dr. WALTER NEEDHAM made an experiment upon a dog, to shew, that the lymphatics of the liver inosculate in the extremity of their trunks with the *pori biliaris*, which, he thought, could not be said of any two distinct sorts of vessels, that carry distinct sorts of liquors in them, throughout the whole body. The experiment was, that the injections of milk and water made into the *pori biliaris* filled not only the *vena cava*, but also the lympheducts, without mixing it with the blood.

He remarked, that he would have made another experiment upon the same dog, if he had been duly fed, which would have shewn, that the chyle possesses not only all the necessities, but likewise all the other lympheducts and glands upon the iliac vessels, and under the cava; and not only so, but that the whole mass of suet, that is upon the loins, is likewise filled with it; in which place, he added, it seemed to be all extravasated, and gathered up again afterwards into the vessels, to be conveyed to the receptaculum. Of which extravasation he mentioned this observable effect, that the fat of the loins differs in several animals, according to the difference of the milk and chyle. Where they are full of butter, and otherwise gross, this fat is thick and solid, as in the suet of bees, sheep, and goats: but where they are thin, the fat is soft and greasy, as may be seen in the leaf of a linc, in dogs, horses, men, &c.

This experiment being made, Dr. NEEDHAM read a discourse of his on the serum of blood, which he was desired to leave with the secretary, in order to be registered: which he consented to, after he had revised it. It was as follows:

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¹ Register, vol. v. p. 125.

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"When I designed the analysis of the liquors of the body, the first, that occurred to my consideration, was the chyle, it being the first product of the nourishment, and consequently the first in order of concoction of all animal liquors. But when I came to inquire into that, I found it impossible to discover the nature of it, till I had before searched out the causes of its production; the two efficient of which seemed to me to be heat and a ferment; both which owing their origin to the mass of blood, it proved necessary to examine the blood itself.

"What blood is, and what are the constituent parts of it, we find many ways delivered in authors, with great variety of opinions, too many and too long to be here recited. I, that designed the satisfaction of my senses first, and my reason afterward, did resolve to follow the most simple and natural way of observation. And first considered the blood as it was let out into a porringer, where all the parts I could observe were two; viz. the grumous cake and the limpid serum. This I do mean of blood, that is pure, without either degeneration of its parts from morbid causes, or recent mixture with chyle; so that the chyle itself unchanged appeareth in the porringer. Those two cakes being removed, I say, that the visible parts, which the blood doth naturally separate itself into, are the two before-mentioned, viz. grumus and serum. Neither are these so very heterogeneous from each other, as upon first sight they may appear; but upon distillation are found to consist of the same parts, differing only in the variety of proportion.

"Indeed if we look into the first originals of blood, we shall find it in its infancy to be pellucid, nor to have any thing red in it; that red colour being the effect of a progress of digestion, by the addition of actual heat, either that of incubation in oviparous, or of the womb in viviparous animals. For the egg itself is limpid, especially the cicatricula, and that so limpid, that itcludeth the best endeavours of the microscope, which might otherwise discover much more of the lineaments of the fœtus in it, than yet the diligence of the great wits of this age can attain to. But when in process of time it doth grow red, and thick, and visibly move in a completely organized body, then it giveth us a fuller view of itself, and better opportunity of satisfying our understandings. We then find the difference I have already mentioned, that appeareth upon the effusion of blood, and its coagulation in a porringer; and if we consider it in its motions in the body, we find things much more observable.

"That I may begin with the first, we find two seemingly unlike parts of it, viz the grumus and serum; yet when we come to analyse them by fire, we find them consist of the same parts, viz. phlegm, spirit, if I may so call it, volatile salt, oil, fixed salt, and earth.

"These, I say, are all to be found, but with this difference of proportion: in the example I chose to work upon, which was bullocks blood, lib. iij. of the serum of bullocks blood, drawn off in MB, yielded of phlegm lib. ij. of a gross extract in the bottom lib. ij. This crassamentum or gross extract in the bottom yielded upon distillation in sand, spirit lib. i. six oil 3j. volatile salt 3j. 3j. gr.

gr. vj. caput mortuum 3ij. 3ij.
 By calcination 3ij. gr. v. Oil the
 which in MB gave us of phlegm
 extract drawn off in sand, yielded
 the caput mortuum came to 3x.
 salt 3j. 3ij. gr. iv.

This caput mortuum did yield of fixed salt
 of the same bullock we took lib. 6.
 grumus of the same 3ij. This lib. v. 3ij. of
 3xiv. extract lib. v 3ij. This lib. v. 3ij. of
 of spirit lib. 4. oil 3j. 3j. volatile salt 3j. 3j.
 This— upon calcination yielded of fixed

Here we see a Great difference of proportion, the serum being more than
 half phlegm, the grumus less than a sixth part; the spirit of the serum about a
 fifth part, of the grumus more than two thirds of the whole.

The oil of the serum but little, viz. 3ij. in lib. iij. nor that of the grumus
 much greater in proportion, viz. 3ix. in lib. vj. The volatile salt of the pru-
 mus triple in proportion to that of the serum; the fixed salt of it much less,
 but that but in small quantity in both places. However, that there is such a
 thing as fixed salt in the blood, and that obtainable by mere calcination and lixi-
 vation, this instance doth sufficiently shew: and indeed all the parts of a hu-
 man body do yield it, though not in great abundance. I do remember a late
 objection made in this place against this doctrine, which was taken from a burnt
 hart's-horn, it being denied, that it yielded any fixed salt. This occasioned me
 to lixiviate some, that I bought ready calcined; it was done calcined, so that
 I did nothing else to it but only powder and lixiviate it, of which operation this
 salt was the product.

Having made these trials in beasts, I thought it good to make an essay upon
 man, and out of a pint of serum found 3v. 3j. of phlegm, 3p. 3vi. sal fixum 2ii.
 but neither volatile salt nor oil. I question, if the persons might not give some
 from which the serum were taken, whether their diseases might not give some
 light to the reason of this difference. But of the grumus of this blood 3x. yielded
 phlegm 3iv. extract 3vj. out of which by resort in sand 3x. oil 3.
 vol. salt 3ij. the cap. mort. being 3j. 3ij. yielded but gr. viii of fixed salt. I had
 a design of further pursuing these experiments, but have been prevented by
 important occasions; so that I am fain to proceed upon what I have already
 done.

By the way let me observe, that as the proportions of the parts vary in these
 two liquors, so do the other phenomena. For when you distil the serum, af-
 ter the drawing off of the phlegm, you will find the extract pretty tough and
 viscid, much of the nature of other gellies; but the grumus, when distilled,
 groweth very after the nature of other gellies; but the grumus, when distilled,
 detained in it. frisable, unless it be in some places, where the serum hath been
 the red part accompany the grumus, which is hardly avoidable, unless you relolve
 to lose much of your serum, then you shall upon distillation find that red part
 gotten to the very bottom of the mass, and there concentered by itself, as being
 heavier than the other, and less miscible than at first one would imagine.

It is yet further observable, that this whole mass is no longer to be kept
 H h 2 mixed

" mixed together than whilst it is kept in that posture by heat and motion; for
 " whenever it cooleth in the porringer it doth separate: I say *motion* and *heat*
 " do concur to the preservation of the mixture: either is sufficient to do it; of
 " which we may give many instances. For a *digestive* heat alone hath kept blood,
 " that was sealed up in a hermetical glass, in its usual fluidity, a month together;
 " and in the body of a man alive, I have known the blood to be as cold as rock-
 " water; yet its circulation kept it fluid. Yet as complete as the mixture seemeth
 " to be in the vessels, it is plain, that percolation maketh a separation of its parts;
 " which is visible in all the percolations in the kidneys, glandules, stomach, guts,
 " &c. and in all other places, where either nutrition or excretion is concerned;
 " which things, if well weighed, may give us occasion of considering the whole
 " doctrine of nutrition and of secretions that attend it, and consequently of in-
 " quiring, what those parts of the blood are, which do immediately contribute
 " to nutrition, and of what parts. We know the old division of parts into fan-
 " guineous and spermatic, the latter of which some of the speculative of this
 " age would have to be nourished only out of the nerves, others more probably
 " out of the serum of the blood, having an influence of the succus nervosus added
 " to it, but the sanguineous parts e grumo sanguinis. The occasion of the dis-
 " tinction was given by the redness, that appeareth in the viscera and muscles, and
 " the paleness, that happened in all the rest; which notwithstanding is but the ef-
 " fect of negligence in examination: for if we do carefully wash any muscle, or
 " the liver itself, by injections we shall find, that they are not red, and conse-
 " quently make a probable conjecture, that they are not nourished by that red
 " part of the blood. But on the other side, if that red part be not nutritious,
 " it will be hard to assign the use of it, whether it be the oily part and fuel for
 " the flame, that is by many supposed to be in the blood, or what else it may be
 " intended for. The notion of a flame being false in the foundation, as I have
 " elsewhere shewed, it will not be convenient to inquire further into it; but, since
 " I have at present undertaken the task, I shall be free in the delivery of my own
 " thoughts concerning this matter; which that I may do with the more advan-
 " tage, I shall take notice, that this redness is not in itself essential to blood, there
 " being many animals, that have it not, and are therefore called exanguious,
 " and the first formation of a body is probably complete before any redness ap-
 " pear in the fœtus; which if compared with what I said of the viscera, may
 " give cause of conjecture, that the red part is only the effect of the long digestion
 " of the blood, which boiling the salts and oil together doth produce the redness
 " we find, it being the extremity of coction in the blood; and being separated
 " from the blood by the liver, proves the matter, out of which choler is made.
 " Now it is true, that choler is of a colour less saturated than this red blood; but
 " the reason of that is not hard to give: for the spleen, if we may believe MATE-
 " RIUS, doth supply a ferment, which being joined to the blood in the porta,
 " may dispose it to that colour; and so much the rather, if the glandules, of
 " which the liver consisteth, do contribute any thing to it. It is worth our pains
 " to consider, that the liver doth perform two distinct excretory offices, one by
 " the pori bilarii of choler, another by the lymphæduls of serum. The lym-
 " phatics are more copious here than in any other part of the body, and, which is
 " to me the most remarkable circumstance, do in the extremity of their trunks
 " imoluate

"in osculate with the pori bilarii; which cannot be said of any two distinct fore
 "of vessels, that carry distinct liquors in them throughout the whole body: the
 "truth of which is easily manifested by injections, which, if cast into the pori
 "bilarii, do not only fill the vena cava (which was SYLVIVS's observation) but
 "the lymphædæ also with the same liquor, viz. milk and water, &c. that is
 "injected without mixing it with the blood: whereas, if we inject into the ar-
 "tery or the porta, no such things will succeed; but it is also observable enough
 "without injections: the very lymphatics, after the death of a dog, if the liquor of them
 "four hours, will turn yellow; and whereas in that animal the liquor of them
 "is four, it will grow bitter, a manifest sign that they have received a tincture
 "from the bilious vessels. A further inquiry into this matter, viz. how one and
 "the same liver maketh a double secretion, and by what glands of another discourse,
 "vessels these works are performed, will be the business of another briefly to take
 "when I shall treat of the bile professedly. It is sufficient here briefly to take
 "notice, what becometh of this red part of the blood, viz. that in the liver it
 "meets with such ferment, whither lincous or lymphatic, as separates it from
 "the blood into the vessels of the gall. The remainder then will be the subject
 "of our present disquisition, which, in contradistinction to the red, I have called
 "serum: the quantity of which, if we well attend to it, we shall find to bear a
 "far greater proportion to the red than we have been hitherto aware; for of the
 "cake, that appeareth in it, a great part is serum, only imprisoned in the viscous
 "tenacity, that ariseth from the oil and salt, which in the crassament, that re-
 "mains upon the drawing off of the phlegm in balneo, is very distinguishable;
 "as also by other circumstances.

"This serum I know not to what more fully to resemble than to the materia
 "prima of ARISTOTELIS; a thing that is actually nothing, but potentially all things.
 "VAN HELMONT collecteth it latex, and describeth it to be humor fatuus & insipidus
 " & concurrens vitarum socius; an insipid liquor, void, as he thought, of any noble
 "parts, only the companion, or rather vehicle of the blood, which served to
 "dilute it in its motions, to swallow up and devour its salts, to wash them off
 "from any part, where they were fixed and coagulated (which he gave for the reason
 "son of humours and cathartics) and at length to carry them off by the kidneys,
 "and the pores of the skin. All this is true; but not all the truth: for this la-
 "tex, thus described, can mean no more than the phlegm of the serum, which is
 "first drawn off in balneo; whereas the serum, as we have contradistinguished
 "it to the grumus, contains a great variety of parts, and the materials out
 "of which all the products of the nourishment eaten, and the excrements of the second
 "third concoction are made: nay, this serum is the provector-general of the
 "body, the instrument of all the concoctions in it. To explain which, I
 "shall first begin with the concoctions: the first being that of the ventricle,
 "I have elsewhere discoursed at large, and shewed that its chief instrument is,
 "the salivary glands, which is but part of the serum separated into the mouth by
 "the glandulous coat thereof. Here the first solution is made,
 "which being a confused mixture of alimentary and excrementitious parts,

"eth both a further digestion, and also a separation. To this end, we find still
 "more serum thrown upon it in the guts, both by the great channel of the duc-
 "tus pancreaticus, and also by the lesser oozings of all the springy pores of the
 "glandulous tunicle of the guts, which promote the former, and also the addi-
 "tion of the bilis, which being mixed with this mass, doth coagulate with what-
 "soever is acid, and maketh it a solid body; whilst what is not acid evades its
 "efficacy, and keeping itself liquid, is squeezed up into the venæ lacteæ. This
 "remark obligeth me to take notice of a great mistake of our modern hypothe-
 "sis-mongers, who have unanimously imputed the concoction of the ventricule to
 "an acid juice; whereas it is notorious to a man, that well considereth it, that
 "this acidity is not the cause, but the effect of concoction, as it is visibly the
 "effect of fermentation in any other liquors, where no acid body was ever added
 "to them, as we see not only in wines, beer, &c. where, by careful occlusion,
 "the liquors are preserved long in the vessels ere they come to it; but in barley
 "water or broth, or any mixed liquor, that is permitted to ferment of itself, it
 "will the sooner fall out, if it be placed in a convenient digesting heat. Now
 "it is most sensible to any man in health, that his saliva is insipid, and so is the
 "succus pancreaticus of a man, which indeed is in all animals proportionable to
 "the saliva. It is as sensible, that where the saliva is insipid, the concocted mass
 "of the stomach is acid, and yet not thin enough, nor otherwise fit by its mixture
 "with excrement to pass much of it up the lacteæ of the stomach itself; yet that
 "some part passeth immediately even that way (viz. the most subtil and tenacious
 "particles of the nourishment) may be judged from the vasa lacteæ, which do de-
 "scend from the back side of the ventricule down into the receptaculum by a short
 "and strait road; which vessels, though not commonly acknowledged, have
 "been guessed at by many writers, and seen by myself; but the main bulk of it
 "passeth into the guts, where it meeteth with its two liquors aforesaid; one of
 "the same nature with the saliva derived from the pancreas and glands of the
 "guts, the other from the vesica fellea. These two liquors, how contrary soever
 "they have been represented to be by SYLVIVS, de GRAAF, &c. do not imme-
 "diately act upon each other, which is from thence demonstrated, viz. that
 "they often in men, and alway in horses and deer, do enter into the guts by one
 "and the same ductus, which, if they had so immediate operation upon each
 "other, would defeat all efficacy they might have upon the juices, for whose
 "service they are designed. But, on the contrary, we find quite other phæno-
 "mena, viz. the present attenuation of all the juices in the duodenum, by the
 "copious addition of the succus pancreaticus, which being yet sweet, doth not
 "act upon the bile, or the bile upon it, but by degrees, as the acidities, which
 "are consequent to concoction, do coagulate with that bile, and make a solid
 "excrement. But this is not all, that is performed upon this nutritious juice; for
 "the serum is yet again cohobated upon it, if I may use the expression, in recep-
 "tculo chyli. The manner and method of which is very pleasant to behold:
 "for it is a very true assertion of SYLVIVS, that the ductus thoracicus, commonly
 "so called, is rather to be termed ductus lymphaticus, it being perpetually filled
 "with lymphæ, and but sometimes only with chyle. He might have as well ap-
 "plied it to all the lymphatics of the lower belly, which do all of them receive
 "chyle

" chyle at the time of the distribution of it, and at other times are found replete
 " with lymph; for, if you open a dog the fifth hour after his feeding, you will
 " find the chyle to possess not only all the mearais, but all the other lymphat-
 " icks and glands upon the iliac vessels, and under the cava, and not only so,
 " but the whole mass of suet, that is upon the loins, is likewise filled with it;
 " in which place it seems to be all extravasated, and to gather up again afterwards
 " into vessels to be conveyed to the receptaculum. There is an observable effect
 " of this extravasation, viz. that the suet of the loins differs in several animals,
 " according to the difference of the milk and chyle: where they are full of but-
 " ter, and otherwise gross, this fat is thick and solid, as in the suet of beeves,
 " sheep, goats; but where they are thin, the fat is soft and greasy, as may be
 " seen in the leaf of a swine, in horses, dogs, men, &c. But whatever the muta-
 " tion is, that happens there, it descendeth at last to the receptacle, where it re-
 " ceiveth vessels of good store from the liver and elsewhere; so that, upon a full
 " imbibition of good store from the liver and elsewhere, and fixed to mingle
 " with the mass in that, it is still more and more fermented, that goeth up
 " with it, and that of which the blood is principally composed, clothed upon it,
 " not making any such momentary mutation of it, either in its own nature; or
 " elsewhere, as some imagine; but gradually worketh it up into its own nature;
 " which being done, it becometh that nutritious body, whose parts have been
 " here represented to you in such manner, as the fire doth explicate them. This
 " juice, as it hath been said already, is indeed the main part of the whole mass;
 " for I do not think the said already, is indeed the main part of the whole mass;
 " it, would be an eighth truly red grumus, if it could be actually separated from
 " parts of the body, and all the juices of it, whither noble or ignoble, do re-
 " ceive their origin; which will be made more conspicuous, if you follow it through
 " all the vessels and organs; in all which it seemeth to me very conspicuous, that
 " the red or grosser part of the blood doth either by anastomoses, or, which
 " is tantamount to the) little adapted pores circulate round, preserving the heat of
 " the body; but that, which enters into the minuted pores, and is the true matter of
 " nutrition, is only the pellucid serum here mentioned. Of this I shall give you
 " many instances, and begin with the most noble, viz. the brain and nerves;
 " to both which what a great copia of large arteries and veins do tend, I have
 " elsewhere shewed, and many of this illustrious Society are well satisfied of by
 " their own observation. These vessels appearing large under the basils of the brain,
 " and in the meninges. These vessels quite through both the cineritious cortex,
 " and also through the medullary white pulp of it, which may visibly be found,
 " not only by injections of medullary white pulp of it, which may visibly be found,
 " cutting of it, and the vessels of the medulla spinalis, do very manifestly discover them-
 " selves to be the ends of the vessels. Yet, after all this, or, if at any time it do,
 " mix the least drop of their red grumous part into it, that there are a secondary
 " it is death to the patient; from whence it is plain, that there are a secondary
 " sort of vessels or pores, call them what you will, which do percolate from it
 " that ferrous matter, out of which all the juice is made. It is true, that the cor-
 " tex hath a little yellowish stain, which intimates to us a faint tincture from the
 " red; but it is so small, that the distensibility of it sufficiently argueth, that the
 " mass of blood doth not pass through it. The like may be said of the medulla
 " spinalis

" and the nerves; all which have copious and large vessels every where playing
 " about them, to give a copious supply of such juices, as are largely expended in
 " them, for the use of both motion and nutrition, and other actions of life: but
 " there also, unless it be the cineritious part, which in the spinal marrow is hid-
 " den as it were in the center, there is not the least tincture of blood, much less
 " in the nerves themselves. But the case is every whit as evident in the glandules,
 " which how copiously they do separate serum from the mass of blood, he must
 " be a novice in anatomy that doth not know: yet it is as plain, that they have
 " not the least tincture of red blood; and though the sanguineous vessels do in
 " some places copiously insert themselves with large branches into them, as it is
 " most visible in the glandulous coat of the stomach and guts, yet, by a great ar-
 " tifice of nature, the communications are so commodiously contrived, that no-
 " thing of the red grumus doth extravasate into them, but is readily carried off
 " by the veins leaving only its serum behind it. The most noble instance, that I
 " find of this kind, is that of the most noble of glandules, I mean the testicle,
 " where so elaborate a separation of serum is made, and improved into so noble
 " a juice, that even here also, how carefully the red grumus is avoided by nature,
 " and what a great mischief it is to it when it happens, I leave to all experi-
 " enced men to judge. Nay, we see, that in the gonorrhoea itself, when there
 " is so copious an expanse of serum, no blood usually entereth the gland, or, if
 " by the overweakness or distention of the vessels, it chance to be admitted, we
 " see what inflammations and dangerous tumours it doth produce. To say the
 " truth, if we well consider the nature of a gonorrhoea, we shall find it to be the
 " same thing to the testicle, that a diabetes is to the kidneys, viz. a flux of the
 " serum sanguinis being by the venereal infection made thinner and sharper, which
 " copiously venteth itself that way. If it were any nobler juice, it were impos-
 " sible, that the strength of nature could bear it, where the flux is so large and
 " long continued; whereas we find, that many men bear great gonorrhoeas to-
 " some space of years, without any great diminution of strength. The parallel
 " diabetes is but the same thing in another place; only in that disease the ex-
 " pence is so very copious, that the treasure of the blood is too much exhausted
 " by it, and consequently perpetually afflicteth the patient with weakness and
 " fainting, because the brain, nerves, and other parts are defrauded of their due
 " supplies. Yet in all this there is no expanse of the red grumus, but a mere per-
 " colation of pellucid serum.

" As to the other viscera, the liver seemeth very suspicious, as being so deeply
 " dyed with red, which the rash happens, because it is the place, where the red
 " mass is principally brought, and where it is concocted into bilis. But as to the
 " parenchyma of that also, if it be duly examined, we shall find, that in all
 " young animals it is pale, till too much passage of the red hath stained it, and
 " in the oldest body, a good syringe and fair water will wash off all that stain,
 " and shew it to be what it is, viz. a glandulous body made out of the serum of
 " the blood, and copiously separating serum from it.

" The same dilution by a syringe will shew the same thing as to the muscles of
 " the body; all of which in young things are pale, and in a cast white; which,

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" could not be, if it were made of red blood; but when by degrees the frequent circulation of the blood through the greater pores hath stained it, will, by the means aforesaid, be brought to itself, and shew, that the parts of it are all a confection out of the serum. For it is not the passage of the blood through the greater pores, that immediately nourisheth; but the depositing of a subtil juice in the minuter pores, into which the main blood never entereth. This the ancients called cambium, ros, & gluten; and, if I were at leisure to consider the whole history of nutrition, I could, from the nature of the serum, thus conveyed into the pores, and of the fibres themselves, in which those pores are excavated, give you a satisfactory account of the growth, status, and decay of animals; of which I have already said something briefly in another place.

" The only suspicious part in the body is the spleen, which doth appear at the first sight a grumous body; but even that also is upon much dilution found to consist chiefly of serum, if not totally; and if any thing of the red be spent upon it, it is a peculiar case, in order to a peculiar ferment, which is afterwards to be exercised in the liver for the separation of gall.

" The bones, membranes, gristles, ligaments, tendons, which are the only remaining parts of the body, are out of dispute.

" I have thus far treated of the serum, both as the efficient cause of concoction, and as the material cause of nourishment in all the parts of the body. The next thing to be attempted is, to explain the manner of its conversion into nutriment of parts, where the salts, sulphurs, &c. will be considered, and the manner of its separating excrements; as also the several degenerations of it in morbid cases."

Dr. NEEDHAM was desired to pursue the work, which he had prescribed himself.

With his discourse he left with Mr. Hooke eighteen glasses for the repository, containing the phlegm, spirits, salts, and oils of the serum and grumous of the blood, as he had analysed them himself.

Mr. OLDENBURG produced and read a letter in French to himself, from Monsieur HUYGENS, dated at the Hague, 15 November, 1675*, accompanied with a little book in 8vo, in Low Dutch, by HERMAN BUSCHOFF, concerning the gout, presented to the Society by Monsieur HUYGENS. It contained a new method of curing the gout by a saltitious substance called *moxa*, prepared out of a dried herb, not named in the book; but

* Letter-book, vol. vii. p. 377.
* An English translation of this book was published at London, 1676, in 8vo, under the title of
Vol. III.

Two Treatises: the one medical of the Gout by HERMAN BUSCHOFF, &c. See Philos. Transact. vol. xi. n.º 135. p. 621.

this prepared substance was laid to be at *Utrecht*, at the house of the brother of the said *BUSCHOFF*.

Mr. OLDENBURG was desired to procure some of this *mona*, and to get the book translated into *England* as soon as possible, and to give the Society an account of the contents of it at their next meeting.

November 29. At a meeting of the *COUNCIL*. were present

The lord viscount <i>BROUNCKER</i> , president,	
<i>Sir JOHN BANKES</i> ,	<i>Mr. COLWALL</i> ,
<i>Sir WILLIAM PETTY</i> ,	<i>Mr. HOSKYNs</i> ,
<i>Sir ROBERT SOUTHWELL</i> ,	<i>Mr. HILL</i> ,
<i>Mr. HENSHAW</i> ,	<i>Mr. OLDENBURG</i> .

It was ordered, that *Sir JOHN BANKES*, *Sir JONAS MOORE*, *Dr. CROUNs*, *Mr. COLWALL*, *Mr. HILL*, and *Mr. HOOKE*, or any two or more of them, whereof *Mr. COLWALL* to be one, do take care to get the possession of the west or white gallery in *Gresham College*, to fit it for a repository, and to remove thither with all possible speed what is in the repository of the Society: and

That it be recommended to the care of *Dr. KING*, to solicit the executors of the late *Dr. WILLIS* for the payment of his arrears to the Society, amounting to twenty pounds and eleven shillings, as appeared from the treasurer's book.

The committee of the council for auditing the treasurer's accounts made their report to the council*.

November 30. being the anniversary election of the Society, there were fifty members present.

Before they proceeded to election, the lord bishop of *Salisbury*, who was then in the chair, as vice-president, the president being prevented from attending by an unexpected impediment, proposed for candidate *George lord viscount HALIFAX*, who by reason of his quality was immediately put to the ballot, and unanimously elected.

Then the committee of the Society for auditing the treasurer's accounts made their report, as follows:

" At a committee of the Royal Society for auditing the treasurer's accounts
" *November 30*, 1675, we find *Mr. COLWALL* the treasurer Debtor.

" To monies he hath received on the several quarterly payments of	} l. s. d.
" the Society from 15th <i>November</i> , 1674, to 15th <i>November</i> ,	
" 1675.	

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* That report is omitted in the Council-book.

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	<i>l.</i>	<i>s.</i>	<i>d.</i>
" To monies received more of Dr. WALLIS in part of his arrears, paid by my lord Brouncker, in consideration of a lecture he read at the Society for his lordship, 12th November, 1674	5	17	0
" To monies more of my lord Brouncker for a lecture read by Dr. GREW for his lordship, 28th October, 1675.	4	0	0
" To money received of the earl of AYLESBURY, for a lecture to be read	2	0	0
" To money received of Sir JOHN LOWTHER for the like purpose	2	0	0
" To money received for admissions	6	0	0
" To monies he received out of the chest	400	0	0
" To balance of his last account, ending 30th November, 1674	25	16	7
	<u>£ 630</u>	<u>1</u>	<u>1</u>

" We find him creditor

l. s. d.

" By the monies he hath paid to the use of the Society, as by the examination of his vouchers doth appear	595	3	8
" By balance resting in cash in his hands	34	17	5
	<u>£ 630</u>	<u>1</u>	<u>1</u>

" Signed ROBERT REDDING,
" THEODORE HAAK,
" ROBERT HOOKE."

This being done, there was read an order, lately made by the council, concerning the leaving some members out of the list printed for this election day; which order was as follows :

" Ordered,

" November 20th, 1675.

" That the president or his deputy be desired to intimate to the Society, on the approaching anniversary election-day, that they could not but take notice of some persons left out of the list; that this was done, because they were found not to have performed their obligation to the Society : and that therefore the council intended to proceed against them according to statute."

These persons were

Dr. BRUCE,
Mr. CARKESSE,
Dr. DOWNS,
Col. COLEPEPPER,

Dr. LOWER,
Sir THO. NOTTE,
Mr. SLINGESBY,
Sir PETER PETT:

After

After this the Society proceeded to election, by which there were continued of the council for the year ensuing

The lord viscount Brouncker,
The earl marshal,
The earl of Aylesbury,
The lord bishop of Salisbury,
Sir JOSEPH WILLIAMSON,
Sir JOHN BANKES,

Sir ROBERT SOUTHWELL,
Mr. HENSHAW,
Mr. COLWALL,
Mr. HILL,
Mr. OLDENBURG.

The ten new members of the council were

The lord bishop of Chester,
Sir PAUL NEILE,
Sir CYRIL WYCHE,
Sir JONAS MOORE,
Dr. PELL,

Dr. HOLDER,
Dr. WALTER NEEDHAM,
Dr. CROUNE,
Dr. GREW,
Mr. MILLES.

Out of the council were elected for officers

The lord viscount Brouncker, president.
Mr. COLWALL, treasurer.
Mr. HENSHAW,
Mr. OLDENBURG, } secretaries.

Several months before this election died a very considerable member of the Society, JONATHAN GODDARD, M. D. who was son of Mr. HENRY GODDARD, a ship carpenter at Deptford in Kent, and born at Greenwich in that county, in the year 1617^{*}. In the beginning of the year 1632, at fifteen years of age, he was admitted commoner of Magdalen Hall in Oxford, where continuing till he was of standing for the degree of bachelor of arts, he left that house, and travelled abroad[†] for his improvement in the study of physic[‡]. After his return to his own country, having taken the degree of bachelor of physic at Christ's College in Cambridge, November 7. 1640, he promised to obey the laws and statutes of the college of physicians in London. He proceeded doctor of physic at Catharine Hall in Cambridge, January 20th, 1647[§], at which time he was a practitioner at London^{||}: and December 22 following admitted candidate of the college of physicians, of which he was chosen fellow, November 4. 1646, and appointed to read the anatomy lecture there March 4. 1647[¶]. At that time he had lodgings in Woodstreet, in the city of London, where Dr. WILKINS, Dr. ENT, Dr. GLISSON, Dr. WALLIS, and other eminent men, met, to cultivate and improve the new philosophy, and laid the first foundation of the Royal Society^{**}. Dr. GODDARD was

^{*} He was fifteen years old in 1631, according to Wood. Athen. Oxon. vol. ii. col. 537.

[†] Id. ibid.

[‡] Ward's Lives of the Professors of Gresham Coll. ge. p. 270.

[§] Ibid.

^{||} Wood, ubi supra.

[¶] Ward, ubi supra.

^{**} Dr. WALLIS's Account of his own life, printed

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physician to the army raised by the parliament, and afterwards to OLIVER CROMWELL, whom he attended both into Ireland and Scotland. December 9. 1651, he was appointed by the parliament warden of Merton College in Oxford, upon the resignation of Sir NATHANIEL BRENT; and January 14. following was incorporated Dr. of physic in that university. In 1652, CROMWELL, then in Scotland, being chancellor of the university of Oxford, did by an instrument, dated October 16. constitute Dr. GODDARD, together with Dr. JOHN OWEN, dean of Christ Church, Dr. WILKINS, warden of Wadham College, Dr. THOMAS GOODWIN, president of Magdalen, and PETER FRINCH, B. D. canon of Christ Church, or any three or more of them, to act as his delegates in all matters relating to grants or dispensations which required his assent. In 1653 Dr. GODDARD was chosen singly to represent the university of Oxford in parliament, and soon after appointed one of the council of state. He was elected professor of physic in Gresham College, November 7. 1655, in the room of Dr. THOMAS WINSTON then lately deceased. He held the wardenship of Merton College till after the restoration, when he was removed by a letter from his majesty, dated July 3. 1660, who claiming Dr. GODDARD to the vacancy of the see of Canterbury, appointed Dr. EDWARD REYNOLDS, one of his chaplains, warden, as successor to Sir NATHANIEL BRENT, no notice being taken of Dr. GODDARD. After this Dr. GODDARD settled himself in Gresham College, and was continued a fellow of the college of physicians by their new charter in 1663. Having been one of the council of it by the first orders of the Royal Society, in 1662, and the second of April 22. 1663, being extremely zealous and active in promoting the design of its institution. For being an accurate chemist, he employed his laboratory at the college in trying many experiments for the use of the Society, as well as for making his own medicines. He died suddenly of an apoplexy, which seized him at the end of Woodstreet in Cheapside, as he was returning from the company of some of his philosophical friends at the Crown Tavern in Bloomsbury, at eleven at night, March 24. 1674, and was the third day after interred in Great St. Helen's Church in Bishop's gate street, on the north side of the chancel, near the rails of a very curious and valuable library of books or inscription. He was master of to have given to the Royal Society, but he dying without a will, they fell to his heir at law, his sister's son, a scholar of Caius College in Cambridge. His character is represented to great advantage by Dr. SETH WARD, in the dedication to him of his book, intitled, *In Immo. Bullialdi sphaericae Fundamenta Inquisitio brevis*, printed at Oxford, 1653, in 4to. in which dedication he is highly commended for his extensive learning, skill in his profession, knowledge of public affairs, generous disposition, candor, affability, and benevolence to all good and learned men.

in Mr. HEARNES's Preface to his edition of LAMBERT's Chronicle, vol. i. p. 167.
 1 Wood, Fasti W. A. & D. ubi supra.
 2 Wood, Fasti W. A. & D. ubi supra.
 3 Id. Athen. Oxon. vol. ii. col. 98.
 4 WARD, ubi supra.
 5 Register of Merton College, cited by bishop

KENNET, Register and Chronicle, p. 17. and
 WARD, p. 270. 274.
 4 GODDARD's Royal College of Physicians of
 London, p. 70.
 5 WOOD, Athen. Oxon. vol. ii. col. 538.
 6 WARD, p. 274.
 7 WOOD, Athen. Oxon. col. 538.

and

and for being the first Englishman who made telescopes. The like complements were paid him by Mr. EDMUND DICKENSON, fellow of Merton-College, in the dedication to him of his *Deſcriptio Phœnixæ*, printed in 1655. And Dr. WALLIS, in 1657, dedicated to him, and to Dr. LANGBAIN, Dr. WILKINSON, and Dr. WILKINS, his *Mathesis universalis*. Besides those writings of his, which were communicated to the Royal Society, he published at London, in 1668, in 8vo. *A Discourse concerning Physic*, and the many *Apocryphes* thereof by Apothecaries; and in 1669, in 4to. *A Discourse setting forth the unhappy condition of the Practise of physic in London*. He left likewise at his death his *Lectures read at Chirurgeons-Hall*, and other pieces, in two volumes in 4to. prepared by him for the press; together with *Arcana Medicinalia*, published at the end of the second edition of *Pharmacopœia Batava*, by JAMES SHIPTON, apothecary, at London, 1691, in 8vo.

December 2. The lord viscount HALLIFAX was admitted.

HENRY HALL, Esq; was proposed candidate by Mr. Le HUNT.

Mr. Le HUNT produced and left with Mr. HOOKE for the repository an iron stone, of which, he said, there were great numbers to be found in Brecknockshire in the parish of Llanethly, yielding more iron than any common iron-ore.

Mr. OLDENBURG read the preface of the Dutch book lately published, sent over by Mons. de ZUYLICHEM, concerning the gout; which preface he has translated into English, containing the occasion, design, and import of that book.

He was desired to send for some of the remedy for the gout out of Holland, where it was said to be had; and to inquire particularly at what intervals of time the author of the book, who had been cured by that medicine, had been troubled with gouty fits, before he made use of this remedy.

Mr. HOOKE was of opinion, that the substance concealed by this author was a kind of spunk.

Mr. OLDENBURG read a letter to himself from Mr. FRANCIS JESSOP of Broomhall in Yorkshire, dated 18 November, 1675, containing a farther account of the fulminating damps in the mines of Wiggernorth, of which he had sent former relation; together with an answer to several queries, that were sent him on that occasion.

Mr. HOOKE mentioned hereupon, that there were two sorts of damps; the one of a moist and gross nature, falling downwards; the other spirituous and very apt to catch fire and to flame: adding, that heretofore in a well on Banstead-downs about three hundred feet deep, he had let down a candle burning to the depth of two hundred feet; but that letting it down deeper, the candle went out.

• Idem, *ibid.* • Letter-book, vol. vii. p. 174. It is printed in the *Philos. Transact.* vol. x. n^o 119. p. 450. for November, 1675. • *Ibid.* n^o 117. p. 391.

Mr.

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Mr. Hooke produced one of his contrivances of lamps formerly discoursed of him, which he explained to the Society, serving to keep a constant degree of heat by lamps at the same height, and being useful to keep a constant degree of heat for hatching of eggs, as also to vary the degrees of lead, and to anneal glass for toughness, and likewise to anneal iron to the softness of lead, &c.

Mr. NEWTON, touching his to explain the

December 9. There was produced a manuscript of Mr. Newton, touching his theory of light and colours, containing partly an hypothesis to explain the properties of light discoloured by him in his former papers, partly the principal phenomena of the various colours exhibited by thin plates of soap, esteemed by him to be of a more difficult consideration; yet to depend also on the said properties of light.

Of the hypothesis only the first part was read, giving an account of refraction, reflection, transparency, and opacity; the second part explaining colours being referred to the next meeting.

The first was as follows: ^b

The first was as follows :

" Sir,

" I have sent you the papers I mentioned, by JOHN STILES. Upon reviewing
" them, I find some things to obscure, as might have deserved a further explanation
" by schemes; and some other things, I guess, will not be new to you, though al-
" most all was new to me when I wrote them. But as they are, I hope you will accept
" of them, though not worth the ample thanks you sent. I thought might be re-
" discourse with Mr. Hooke, I happened to say, that I thought might be re-
" flected, not by the parts of glass, water, air, or other sensible mediums, but by
" the same confine or superficies of the æthereal mediums, of the denser into
" rays finding some difficulty to get through it in passing out of the rarer into
" the rarer medium, and a greater difficulty in passing out of the superficies, as the
" denser; and so being either refracted or reflected by them, made them able or
" circumstances they happened to be in at their incidence made this air, would not
" unable to get through it. And, for confirmation of glass into air, as is ought
" I thought the reflection of light, at its tending out of an air-pump, as I had not
" to be diminished or weakened by drawing away the air in an air-pump, with notions of
" tried this experiment, and by drawing away the air that was new, and he would the
" this kind. But I thought he was not acquainted with the notion was new, and upon reviewing the
" first opportunity to which he replied, that the notion was new, and upon reviewing the
" papers I send you, I found it there set down for tried; which makes me recol-
" lect, that about you, I found it there set down for tried; which makes me recol-
" in an air-pump, here at Christ's College, that I could not perceive the reflection
" of the inside of the glass diminished by drawing out the air. This I thought
" fit to mention, lest my former forgetfulness, through having long laid aside
" my thoughts on these things, should make me seem to have laid down for cer-
" tain what I never tried.

Stiles.

6. Since

¹ Register, vol. v. p. 64.

" Sir, I had formerly purposed never to write any hypothesis of light and colours, fearing it might be a means to engage me in vain disputes: but I hope a declared resolution to answer nothing, that looks like a controversy, unless possibly at my own time upon some by-occasion, may defend me from that fear. And therefore considering, that such an hypothesis would much illustrate the papers I promised to send you; and having a little time this last week to spare, I have not scrupled to describe one, so far as I could on a sudden recollect my thoughts about it; not concerning myself, whether it shall be thought probable or improbable, so it do but render the papers I send you, and others sent formerly, more intelligible. You may see, by the scratching and interlining, it was done in haste; and I have not had time to get it transcribed, which makes me say I reserve a liberty of adding it; and desire, that you would return those and the other papers when you have done with them. I doubt there is too much to be read at one time, but you will soon know how to order that. At the end of the hypothesis you will see a paragraph to be inserted as is there directed: I should have added another or two, but I had not time, but such as it is, I hope you will accept it. Sir, I am, &c.

Is. NEWTON.

" An Hypothesis explaining the Properties of Light, discoursed of in my several Papers.

" Sir,

" In my answer to Mr. Hooke, you may remember, I had occasion to say something of hypotheses, where I gave a reason, why all allowable hypotheses in their genuine constitution should be conformable to my theories; and said of Mr. Hooke's hypothesis, that I took the most free and natural application of it to phenomena to be this: that the agitated parts of bodies, according to their several sizes, figure, and motions, do excite vibrations in the æther of various depths or bignesses, which being promiscuously propagated through that medium to our eyes, effect in us a sensation of light of a white colour; but if by any means those of unequal bignesses be separated from one another, the largest beget a sensation of a red colour; the least, or shortest, of a deep violet; and the intermediate ones, of intermediate colours: much after the manner that bodies, according to their several sizes, shapes, and motions, excite vibrations in the air of various bignesses, which, according to those bignesses, make several tones in sound, &c. I was glad to understand, as I apprehend, from Mr. Hooke's discourse at my last being at one of your assemblies, that he had changed his former notion of all colours being compounded of only two original ones, made by the two sides of an oblique pulse; and accommodated his hypothesis to this my suggestion of colours, like sounds, to be a more plausible hypothesis than any other described by former authors, because I see not how the colours of thin transparent plates or skins can be handsomely explained, without having recourse to æthereal pulses: but yet I

Transact. n^o 88. p. 5088.

.. like

"like another hypothesis better, which I had occasion to hint something of in the same letter in these words¹:

"The hypothesis of light's being a body, had I propounded it, has a much greater affinity with the object's own hypothesis, than he seems to be aware of; the vibrations of the æther being as useful and necessary in this as in his. For, assuming the rays of light to be small bodies emitted every way from shining substances, these, when they impinge on any refracting or reflecting superficies, must as necessarily excite vibrations in the æther, as stones do in water when thrown into it. And, supposing these vibrations to be of several depths or thickneses, accordingly as they are excited by the said corpuscular rays of various sizes and velocities; of what use they will be for explicating the manner of reflexion and refraction, the production of heat by the sun-beams; the emission of light from burning, putrifying, or other substances, whose parts are vehemently agitated; the phenomena of thin transparent plates, and bubbles, and of all natural bodies, the manner of vision, and the dispersion of colours, as also their harmony and discord; I shall leave to their consideration, who may think it worth their endeavour to apply this hypothesis to the solution of phenomena.

"Were I to assume an hypothesis, it should be this, if propounded more generally, so as not to determine what light is, farther than that it is something or other capable of exciting vibrations in the æther: for thus it will become so general and comprehensive of other hypotheses, as to leave little room for new ones to be invented. And therefore, because I have observed the heads of some great virtuofos to run much upon hypotheses, as if my discourses wanted an hypothesis to explain them by, and found, that some, when I could not make them take my meaning, when I spoke of the nature of light and colours abstractedly, have readily apprehended it, an hypothesis; for this reason I have here, when I illustrated my discourse by a description of the circumstances of this hypothesis as much tending to the illustration of the papers I herewith send you. And though I shall not assume either this or any other hypothesis, not thinking it necessary to concern myself, whether the properties of light, discovered by me, be explained by this, or Mr. Hooke's, or any other hypothesis capable of explaining them; yet while I am describing this, I shall sometimes, to avoid circumlocution, and to represent it more conveniently, speak of it, as if I assumed it, and propounded it to be believed. This I thought fit to express, that no man may confound this with my other discourses, or measure the certainty of one by the other, or think me obliged to answer objections against this script: for I desire to decline being involved in such troublesome and insignificant disputes.

"But to proceed to the hypothesis: First, it is to be supposed therein, that there is an æthereal medium much of the same constitution with air, but far rarer, subtler, and more strongly elastic. Of the existence of this medium the motion of a pendulum in a glass exhausted of air almost as quickly as in

" the open air, is no inconsiderable argument. But it is not to be supposed,
 " that this medium is one uniform matter, but compounded, partly of the main
 " phlegmatic body of aether, partly of other various æthereal spirits, much after
 " the manner, that air is compounded of the phlegmatic body of air intermixed
 " with various vapours and exhalations: for the electric and magnetic effluvia,
 " and gravitating principle, seem to argue such variety. Perhaps the whole
 " frame of nature may be nothing but various contextures of some certain æthe-
 " real spirits, or vapours, condensed as it were by precipitation, much after the
 " manner, that vapours are condensed into water, or exhalations into grosser sub-
 " stances, though not so easily condensable; and after condensation wrought into
 " various forms; at first by the immediate hand of the Creator; and ever since
 " by the power of nature; which, by virtue of the command, increase and
 " multiply, became a complete imitator of the copies set her by the protoplast.
 " Thus perhaps may all things be originated from æther.

" At least, the elastic effluvia seem to instruct us, that there is something of
 " an æthereal nature condensed in bodies. I have sometimes laid upon a table
 " a round piece of glass about two inches broad set in a brass ring, so that the
 " glass might be about one eighth or one sixth of an inch from the table, and
 " the air between them inclosed on all sides by the ring, after the manner as if
 " I had whelmed a little sieve upon the table; and then rubbing a pretty while
 " the glass briskly with some rough and raking stuff, till some very little fragments
 " of very thin paper, laid on the table under the glass, began to be attracted and
 " move nimbly to and fro; after I had done rubbing the glass, the papers would
 " continue a pretty while in various motions; sometimes leaping up to the glass
 " and resting there a while; then leaping down and resting there; then leaping
 " up, and perhaps down and up again, and this sometimes in lines seeming per-
 " pendicular to the tables, sometimes in oblique ones; sometimes also they would
 " leap up in one arch and down in another, divers times together, without
 " sensibly resting between; sometimes skip in a bow from one part of the glass
 " to another without touching the table, and sometimes hang by a corner, and
 " turn often about very nimbly, as if they had been carried about in the midst
 " of a whirlwind, and be otherwise variously moved, every paper with a diverse
 " motion. And upon sliding my finger on the upper side of the glass, though
 " neither the glass, nor inclosed air below, were moved thereby, yet would the
 " papers, as they hung under the glass, receive some new motion, inclining this
 " way or that way, accordingly as I moved my finger. Now, whence all these
 " irregular motions should spring, I cannot imagine, unless from some kind of
 " subtil matter lying condensed in the glass, and rarified by rubbing, as water is
 " rarified into vapour by heat, and in that rarefaction diffused through the space
 " round the glass to a great distance, and made to move and circulate variously,
 " and accordingly to actuate the papers till it return into the glass again, and be
 " recondensed there. And as this condensed matter by rarefaction into an æthe-
 " real wind (for by its easy penetrating and circulating through glass I esteem it
 " æthereal) may cause these odd motions, and by condensing again may cause
 " electrical attraction with its returning to the glass to succeed in the place of
 " what is there continually recondensed; so may the gravitating attraction of the
 " earth

"earth be caused by the continual condensation of some other such like æthereal spirit, not of the main body of phlegmatic æther, but of something very thinly and subtilly diffused through it, perhaps of an unctuous or gummy, teacious, and springy nature, and bearing much the same relation to æther, which the vital æreal spirit, requisite for the conservation of flame and vital motions, does to air. For, if such an æthereal spirit may be condensed in fermenting or burning bodies, or otherwise coagulated in the pores of the earth and water into some kind of humid active matter, for the continual uses of nature, adhering to the sides of those pores, after the continual uses of condense on the sides of a vessel; the vast body of the manner that vapours every where to the very center in perpetual working, may continually condense so much of this spirit, as to cause it from above to descend with great celerity for a supply; in which descent it may bear down with it the bodies it pervades with force proportional to the superficies of all their parts it acts upon; nature making a circulation by the slow ascent of as much matter out of the bowels of the earth in an æreal form, which, for a time, constitutes the atmosphere; but being continually buoyed up by the new air; exhalations and vapours rising underneath, at length (some part of the vapours, which return in rain, excepted) vanishes again into the æthereal spaces, and there perhaps in time renews, and is attenuated into its first principle: for nature is a perpetual worker, generating fluids out of solids, and solids out of fluids, fixed things out of volatile, and volatile out of fixed, subtil out of gross and gross out of subtil; some things to ascend, and make the upper terrestrial juices, rivers, and the atmosphere; and by consequence, others to descend for a requital to the former. And, as the earth, so perhaps may the sun imbibe this spirit copiously, to conserve his shining, and keep the planets from receding further from him. And they, that will, may also suppose, that this spirit affords or carries with it thither the solar fewel and material principle of light: and that the vast æthereal spaces between us and the stars are for a sufficient repository for this food of the sun and planets. But this of the constitution of æthereal natures by the by.

"In the second place, it is to be supposed, that the æther is a vibrating medium like air, only the vibrations far more swift and minute; those of air, made by a man's ordinary voice, succeeding one another at more than half a foot or a foot distance; but those of æther at a less distance than the hundred thousandth part of an inch. And, as in air the vibrations are some larger than others, but yet all equally swift (for in a ring of bells the sound of every tone is heard at two or three miles distance, in the same order that the bells are struck; so, I suppose, the æthereal vibrations differ in bigness, but not in swiftness. Now, these vibrations, beside their use in reflexion and refraction, may be supposed the chief means, by which the parts of fermenting or purifying substances, fluid liquors, or melted, burning, or other hot bodies, continue in motion, are shaken asunder like a ship by waves, and dissipated into vapours, exhalations, or smoke, and light loosed or excited in those bodies, and consequently by which a body becomes a burning coal, and smoke, flames; and, I suppose, flame is nothing but the particles of smoke turned by the access of light and heat to burning coals, little and innumerable.

K k 2

æther.

" *Thirdly*, as the air can pervade the bores of small glass pipes, but yet not so
 " easily as if they were wider; and therefore stands at a greater degree of rarity
 " than in the free aerial spaces, and at so much a greater degree of rarity as the
 " pipe is smaller, as is known by the rising of water in such pipes to a much
 " greater height than the surface of the stagnating water, into which they are
 " dipped; so I suppose æther, though it pervades the pores of crystal, glass,
 " water, and other natural bodies, yet it stands at a greater degree of rarity in
 " those pores, than in the free æthereal spaces, and at so much a greater degree of
 " rarity, as the pores of the body are smaller. Whence it may be, that the spirit
 " of wine, for instance, though a lighter body, yet having subtler parts, and
 " consequently smaller pores, than water, is the more strongly refracting liquor.
 " This also may be the principal cause of the cohesion of the parts of solids and
 " fluids, of the springiness of glass, and bodies, whose parts slide not one upon
 " another in bendings, and of the standing of the mercury in the Torricellian
 " experiment, sometimes to the top of the glass, though a much greater height
 " than twenty-nine inches. For the denser æther, which surrounds these bodies,
 " must crowd and press their parts together, much after the manner that air
 " surrounding two marbles presses them together, if there be little or no air be-
 " tween them. Yea, and that puzzling problem; *By what means the muscles are*
 " *contracted and dilated to cause animal motion, may receive greater light from hence*
 " *than from any means men have hitherto been thinking on.* For, if there be any
 " power in man to condense and dilate at will the æther, that pervades the
 " muscles, that condensation or dilation must vary the compression of the muscle,
 " made by the ambient æther, and cause it to swell or shrink accordingly. For
 " though common water will scarce shrink by compression, and swell by relax-
 " ation, yet (so far as my observation reaches) spirit of wine and oil will; and
 " Mr. Boyle's experiment of a tadpole shrinking very much by hard compres-
 " sion the water, in which it swam, is an argument, that animal juices do the
 " same. And as for their various pression by the ambient æther, it is plain,
 " that they must be more or less accordingly as there is more or less æther with-
 " in, to sustain and counterpoise the pressure of that without. If both æthers
 " were equally dense, the muscle would be at liberty, as if pressed by neither:
 " if there were no æther within, the ambient would compress it with the whole
 " force of its spring. If the æther within were twice as much dilated as that
 " without, so as to have but half as much springiness, the ambient would have
 " half the force of its springiness counterpoised thereby, and exercise but the
 " other half upon the muscle; and so in all other cases the ambient compresses
 " the muscle by the excess of the force of its springiness above that of the spring-
 " iness of the included. To vary the compression of the muscle therefore, and
 " so to swell and shrink it, there needs nothing but to change the consistence
 " of the included æther; and a very little change may suffice, if the spring of
 " æther be supposed very strong, as I take it to be many degrees stronger
 " than that of air.

" Now for the changing the consistence of the æther; some may be ready to
 " grant, that the soul may have an immediate power over the whole æther in
 " any part of the body, to swell or shrink it at will: but then how depends the
 " muscular

" muscular motion on the nerves? Others therefore may be more apt to think
 " it done by some certain æthereal spirit included within the *dura mater*, which
 " the soul may have power to contract or dilate at will in any muscle, and so
 " cause it to draw thither through the nerves. But still there is a difficulty, and so
 " this force of the soul upon it does not take off the power of its springiness, why
 " whereby it should sustain, more or less, the force of the outward æther. A
 " third supposition may be, that the soul has a power to inspire any muscle with
 " this spirit, by impelling it thither through the nerves. But this too has its
 " difficulties, for it requires a forcible intending the springs of the æther in the
 " muscles, by pressure exerted from the parts of the brain: and it is hard to
 " conceive, how so great force can be exercised amidst so tender matter as the
 " brain is. And besides, why does not this æthereal spirit, being subtil enough,
 " and urged with so great force, go away through the *dura mater* and skins of
 " the muscle; or at least so much of the other rather go out to make way for
 " this, which is crowded in? To take away these difficulties is a digression; but
 " seeing the subject is a deserving one, I shall not stick to tell you how I think
 " it may be done.

" First then, I suppose, there is such a spirit; that is, that the animal spirits
 " are neither like the liquor, vapour, or gas of spirit of wine; but of an æthereal
 " nature, subtil enough to pervade the animal juices, as freely as the electric, or
 " perhaps magnetic, effluvia do galls. And to know, how the coats of the
 " brain, nerves, and muscles, may become a convenient vessel to hold so subtil
 " a spirit, you may consider, how liquors and spirits are disposed to pervade or
 " not pervade things on other accounts than their subtilty. Water and oil per-
 " vade wood and stone, which quicksilver does not; and quicksilver metals,
 " which water and oil do not: water and acid spirits pervade salts, which oil
 " and spirit of wine do not; and oil and spirit of wine pervade sulphur, which
 " water and acid spirits do not. So some fluids, as oil and water, though their
 " parts are in freedom enough to mix with one another, yet by some secret
 " principle of unfociableness they keep asunder; and some, that are sociable, may
 " become unfociable, by adding a third thing to one of them, as water to spirit
 " of wine, by dissolving salt of tartar in it. The like unfociableness may be in
 " æthereal natures, as perhaps between the æthers in the vortices of the sun and
 " planets; and the reason, why air stands rarer in the boxes of small glass-pipes,
 " and æther in the pores of bodies, than elsewhere, may be, not want of lub-
 " tilty, but sociableness. And on this ground, if the æthereal vital spirit in a
 " man be very sociable to the marrow and juices, and unfociable to the coats of
 " the brain, nerves, and muscles, or to any thing lodged in the pores of those
 " coats, it may be contained thereby, notwithstanding its subtilty; especially if
 " we suppose no great violence done to it to squeeze it out; and that it may not
 " be altogether so subtil as the main body of æther, though subtil enough to
 " pervade readily the animal juices, and that, as any of it is spent, it is continu-
 " ally supplied by new spirit from the heart.

" In the next place, for knowing how this spirit may be used for animal mo-
 " tion, you may consider, how some things unfociable are made sociable by the
 " mediation

"mediation of a third. Water, which will not dissolve copper, will do it, if the copper be melted with sulphur: aqua fortis, which will not pervade gold, will do it by addition of a little sal armoniac, or spirit of salt: lead will not mix in melting with copper, but if a little tin or antimony be added, they mix readily, and part again of their own accord, if the antimony be waited by throwing salt-peter or otherwise: and so lead melted with silver quickly pervades and liquifies the silver in a much less heat than is requisite to melt the silver alone; but, if they be kept in the test till that little substance, that reconciled them, be wasted or altered, they part again of their own accord. And, in like manner, the æthereal animal spirit in a man may be a mediator between the common æther and the muscular juices, to make them mix more freely: and so, by sending a little of this spirit into any muscle, though so little as to cause no sensible tension of the muscle by its own force; yet, by rendering the juices more sociable to the common external æther, it may cause that æther to pervade the muscle of its own accord in a moment more freely and copiously than it would otherwise do, and to recede again as freely, so soon as this mediator of sociableness is retracted. Whence, according to what I said above, will proceed the swelling or shrinking of the muscle, and consequently the animal motion depending thereon.

"Thus may therefore the soul, by determining this æthereal animal spirit or wind into this or that nerve, perhaps with as much ease as air is moved in open spaces, cause all the motions we see in animals: for the making which motions strong, it is not necessary, that we should suppose the æther within the muscle very much condensed or rarified by this means, but only that its spring is so very great, that a little alteration of its density shall cause a great alteration in the pressure. And what is said of muscular motion, may be applied to the motion of the heart, only with this difference, that the spirit is not sent thither, as into other muscles, but continually generated there by the fermentation of the juices, with which its flesh is replenished, and as it is generated, let out by starts into the brain through some convenient ductus to perform those motions in other muscles by impression, which it did in the heart by its generation. For I see not, why the ferment in the heart may not raise as subtil a spirit out of its juices, to cause these motions, as rubbing does out of a glass, to cause electric attraction, or burning out of fuel, to penetrate glass, as Mr. Boyle has shewn, and caline by corrosion metals melted therein.

"Hitherto I have been contemplating the nature of æther and æthereal substances by their effects and uses; and now I come to join therewith the consideration of light.

"In the fourth place therefore, I suppose light is neither æther, nor its vibrating motion, but something of a different kind propagated from lucid bodies. They, that will, may suppose it an aggregate of various peripatetic qualities. Others may suppose it multitudes of unimaginable small and swift corpuscles of various sizes, springing from shining bodies at great distances one after another; but yet without any sensible interval of time, and continually urged forward by a principle

" principle of motion, which in the beginning accelerates them, till the resilience
 " of the æthereal medium equal the force of that principle, much alter the
 " manner that bodies let fall in water are accelerated till the resilience of the wa-
 " ter equals the force of gravity. God, who gave animals self-motion beyond
 " our understanding, is, without doubt, able to implant other principles of mo-
 " tion in bodies, which we may understand as little. Some would readily grant
 " this may be a spiritual one; yet a mechanical one might be shewn, did not I
 " think it better to pass it by. But they, that like not this, may suppose light
 " any other corporeal emanation, or any impulse or motion of any other medium
 " or æthereal, it is diffused through the main body of æther, or what else they
 " can imagine proper for this purpose. To avoid dispute, and what else they
 " thesis general, let every man here take his fancy: only, whatever light be, I
 " suppose, it consists of rays differing from one another in contingent light be, I
 " stances, as bigness, form, or vigour; like as the sands on the shore, the waves
 " of the sea, the faces of men, and all other natural things of the same kind
 " differ; it being almost impossible for any sort of things to be found without
 " some contingent variety. And further, I would suppose it diverse, from the
 " vibrations of the æther, because (besides, that were it these vibrations, it
 " ought always to verge copiously in crooked lines into the dark or quiescent
 " medium, destroying all shadows; and to comply readily with any crooked pores
 " or passages, as solids do,) I see not how any superficies (as the side of a glass
 " prism, on which the rays within are incident at an angle of above forty de-
 " grees; can be totally opaque. For the vibrations bearing against the refract-
 " ing confine of the rarer and denser æther must needs make that plant super-
 " ficies undulate, and those undulations will stir up and propagate vibrations on
 " the other side. And further, how light, incident on very thin skins or plates
 " of any transparent body, should, for many successive thicknesses of the plate
 " in arithmetical progression, be alternately reflected and transmitted, as I find
 " it is, puzzles me as much. For, though the arithmetical progression of those
 " thicknesses, which reflect and transmit the rays alternately, argues, that it de-
 " pends upon the number of vibrations between the two superficies of the plate,
 " whether the ray shall be reflected or transmitted: yet I cannot see, how the
 " number should vary the case, be it greater or less, whole or broken, unless
 " light be supposed something else than these vibrations. Something indeed
 " I could fancy towards helping the two last difficulties, but nothing which I see
 " not insufficient.

" Fifthly, it is to be supposed, that light and æther mutually act upon one
 " another, æther in refracting light, and light in warming æther; and that the
 " densest æther acts most strongly. When a ray therefore moves through æther
 " of uneven density, I suppose it most pressed, urged, or acted upon by the me-
 " dium on that side towards the denser æther, and receives a continual im-
 " pulse from that side to recede towards the rarer, and so is accelerated, if it move
 " that way, or retarded, if the contrary. On this ground, if a ray move
 " obliquely through such an unevenly dense medium (that is, obliquely to those
 " imaginary superficies, which run through the equally dense parts of the me-
 " dium, and may be called the refracting superficies) it must be incurved, as it

" it must have become parallel to CD, before it had arrived at EF, the further
 " side of the refracting superficies; and so could have got no nearer to EF, but
 " must have turned back by further incurvation, and been reflected, as it is re-
 " presented at $A \mu V \lambda$. And the like would have happened, if the density
 " of the æther had further increased from EF to P Q; so that P Q H G might
 " be a denser medium than E F H G was supposed; for then the ray, in pass-
 " ing from m to n , being so much incurved, as at u to become parallel to CD
 " or P Q, it is impossible it should ever get nearer to P Q, but must at n be-
 " gin by further incurvation to turn back, and so be reflected. And because, if
 " a refracted ray, as $n L$, be made incident, the incident, $A m$, shall become the
 " refracted; and therefore, if the ray $A \mu V$, after it is arrived at V, where I
 " suppose it parallel to the refracting superficies, should be reflected perpendicu-
 " larly back, it would return back in the line of incidence $V \mu A$. Therefore
 " going forward, it must go forward in such another line, $V \mu$, both cases be-
 " ing alike, and so be reflected at an angle, equal to that of incidence.

" This may be the cause and manner of reflection, when light tends from the
 " rarer towards the denser æther: but to know, how it should be reflected,
 " when it stands from the denser towards the rarer, you are further to consider,
 " how fluids near their superficies are less pliant and yielding than in their more
 " inward parts; and, if formed into thin plates, or shells, they become much
 " more stiff and tenacious than otherwise. Thus, things, which become much
 " water, if let fall upon a bubble of water, they do not easily break through it,
 " but are apt to slide down by the sides of it, if they be not too big and heavy.
 " So, if two well polished convex glasses, ground on very large spheres, be laid
 " one upon another, the air between them easily recedes, till they almost touch;
 " but then begins to resist so much, that the weight of the upper glass is too
 " little to bring them together so as to make the black, mentioned in the other
 " papers I send you, appear in the midst of the rings of colours: and, if the
 " glasses be plain, though no broader than a two-pence, a man with his whole
 " strength is not able to press all the air out from between them, so as to make
 " them fully touch. You may observe also, that insects will walk upon water
 " without wetting their feet, and the water bearing them up; also moles fall-
 " ling upon water will often lie long upon it without being wetted: and so,
 " I suppose, æther in the confine of two mediums is less pliant and yielding
 " than in other places, and so much the less pliant by how much the mediums
 " differ in density: so that in passing out of denser æther into rarer, when there
 " remains but a very little of the denser æther to be past through, a ray finds
 " mediums are of very differing density, as to be reflected by incurvation, after
 " the manner described above; the parts of æther on that side, where they are
 " would do were they denser there than on the other side: for the resistance of
 " the medium ought to have the same effect on the ray, from what cause soever
 " it arises. And this, I suppose, may be the cause of the reflection of quick-
 " silver, and other metalline bodies. It must also concur to increase the reflective
 " virtue of the superficies, when rays tend out of the rarer medium into the
 " denser.

You. III.

L I

“ denser ; and, in that case therefore, the reflection having a double cause, ought
 “ to be stronger than in the æther, as it is apparently. But in refraction, this ri-
 “ gid tenacity or unpliability of the superficies need not be considered, because
 “ so much as the ray is thereby bent in passing to the most tenacious and rigid
 “ part of the superficies, so much it is thereby unbent again in passing on from
 “ thence through the next parts gradually less tenacious.

“ Thus may rays be refracted by some superficies, and reflected by others, be-
 “ the medium they tend into, denser or rarer. But it remains further to be ex-
 “ plained, how rays alike incident on the same superficies (suppose of crystal, glass,
 “ or water) may be at the same time some refracted, others reflected. And for ex-
 “ plaining this, I suppose, that the rays, when they impinge on the rigid resist-
 “ ing æthereal superficies, as they are acted upon by it, so they react upon it and
 “ cause vibrations in it, as stones thrown into water do in its surface ; and that
 “ these vibrations are propagated every way into both the rarer and denser me-
 “ diums ; as the vibrations of air, which cause sound, are from a stroke, but yet
 “ continue strongest where they began, and alternately contract and dilate the æther
 “ in that physical superficies. For it is plain by the heat, which light produces in
 “ bodies, that it is able to put their parts in motion, and much more to heat and
 “ put in motion the more tender æther ; and it is more probable, that it com-
 “ municates motion to the gross parts of bodies by the mediation of æther than
 “ immediately ; as for instance, in the inward parts of quicksilver, tin, silver,
 “ and other very opaque bodies, by generating vibrations, that run through them,
 “ than by striking the outward parts only, without entering the body. The shock
 “ of every single ray may generate many thousand vibrations, and by sending
 “ them all over the body, move all the parts, and that perhaps with more mo-
 “ tion than it could move one single part by an immediate stroke ; for the vi-
 “ brations, by shaking each particle backward and forward, may every time
 “ increase its motion, as a ringer does a bell by often pulling it, and so at length
 “ move the particles to a very great degree of agitation, which neither the simple
 “ shock of a ray, nor any other motion in the æther, besides a vibrating one could
 “ do. Thus in air shut up in a vessel, the motion of its parts caused by heat,
 “ how violent soever, is unable to move the bodies hung in it, with either a trem-
 “ bling or progressive motion ; but if air be put into a vibrating motion by beat-
 “ ing a drum or two, it shakes glass-windows, the whole body of a man, and
 “ other massy things, especially those of a congruous tone : yea I have observed it
 “ manifestly shake under my feet a cellared free-stone floor of a large hall, so as,
 “ I believe, the immediate stroke of five hundred drumsticks could not have done,
 “ unless perhaps quickly succeeding one another at equal intervals of time. Æthe-
 “ real vibrations are therefore the best means by which such a subtle agent as
 “ light can shake the gross particles of solid bodies to heat them : and so sup-
 “ posing that light, impinging on a refracting or reflecting æthereal superficies, puts
 “ it into a vibrating motion, that physical superficies being by the perpetual ap-
 “ pulse of rays always kept in a vibrating motion, and the æther therein conti-
 “ nually expanded and compressed by turns ; if a ray of light impinge upon it,
 “ while it is much compressed, I suppose it is then too dense and stiff to let the ray pass

" pass through, and so reflects it; but the rays, that impinge on it at other times,
 " when it is either expanded by the interval of two vibrations, or not too much
 " compressed and condensed, go through and are refracted.

" These may be the causes of refractions and reflections in all cases; but, for
 " understanding how they come to be so regular, it is further to be considered,
 " that in a heap of sand, although the surface be rugged, yet if water be poured,
 " on it to fill its pores, the water, so soon as its pores are filled, will evenly over-
 " spread the surface, and so much the more evenly, as the sand is finer: so, al-
 " though the surface of all bodies, even the most polished, be rugged, as I con-
 " ceive, yet where that ruggedness is not too gross and coarse, be rugged, as I con-
 " sider, the surfaces may evenly overspread it. In polishing glasses or metal, it is not
 " to be imagined, that sand, putty, or other fretting powders, should wear the
 " surface so regularly, as to make the front of every particle exactly plain, and
 " all those plains look the same way, as they ought to do in well polished bodies,
 " were reflection performed by their parts: but that those fretting powders should
 " wear the bodies first to a coarse ruggedness, such as is sensible, and then to a finer
 " and finer ruggedness, till it be so fine that the æthereal superficies even to a finer
 " spreads it, and so makes the body put on the appearance of a polish, is a very na-
 " tural and intelligible supposition. So in fluids, it is not well to be conceived, that
 " the surfaces of their parts should be all plain, and the plains of the superficial parts
 " always kept looking all the same way, notwithstanding that they are in perpetual
 " motion. And yet without these two suppositions, the superficies of fluids could
 " not be so regularly reflexive as they are, were the reflexion done by the parts them-
 " selves, and not by an æthereal superficies evenly overspreading the fluid.

" Further, concerning the regular motion of light, it might be suspected, whe-
 " ther the various vibrations of the fluid, through which it passes, may not much
 " disturb it; but that suspicion, I suppose, will vanish, by considering, that
 " if at any time the foremost part of an oblique wave begin to turn it awry,
 " the hindermost part, by a contrary action, must soon set it straight again.

" Lastly, because without doubt there are, in every transparent body, pores of
 " various sizes, and I said, that æther stands at the greatest rarity in the smallest
 " pores: hence the æther in every pore should be of a differing rarity, and so
 " light be refracted in its passage out of every pore into the next, which would
 " cause a great confusion, and spoil the body's transparency. But considering that
 " the æther, in all dense bodies, is agitated by continual vibrations, and these vi-
 " brations cannot be performed without forcing the parts of æther forward and
 " backward, from one pore to another, by a kind of tremor, so that the æther,
 " which one moment is in a greater pore, is the next moment forced into a less;
 " and on the contrary, this must evenly spread the æther into all the pores not
 " exceeding some certain bigness, suppose the breadth of a vibration, and so make
 " it of an even density throughout the transparent body, agreeable to the middle
 " sort of pores. But where the pores exceed a certain bigness, I suppose
 " the æther suits its density to the bigness of the pore, or to the medium within
 " it; and so being of a diverse density from the æther that surrounds it, reflects
 " it

“ or reflects light in its superficies, and so make the body, where many such infertifices are, appear opaque.”

Some of the members taking particular notice, among other things, of an experiment mentioned in this hypothesis, desired, that it might be tried; viz. that having laid upon a table a round piece of glass, about two inches broad, in a brass ring; so that the glass might be one third part of an inch from the table; and then rubbing the glass briskly, till some little fragments of paper laid on the table under the glass began to be attracted, and move nimbly to and fro; after he had done rubbing the glass, the papers would continue a pretty while in various motions, sometimes leaping up to the glass, and resting there a while, then leaping down, and resting there, and then leaping up and down again, and this sometimes in lines seeming perpendicular to the table, sometimes in oblique ones; sometimes also leaping up in one arch, and leaping down in another divers times together, without sensibly resting between; sometimes skipping in a bow from one part of the glass to another, without touching the table, and sometimes hanging by a corner, and turning often about very nimbly, as if they had been carried about in the middle of a whirlwind; and being otherwise variously moved, every paper with a different motion. And upon sliding his finger upon the upper side of the glass, though neither the glass nor the inclosed air below were moved thereby, yet would the papers, as they hung under the glass, receive some new motion, inclining this or that way, according as he moved his finger.

This experiment Mr. NEWTON proposed to be varied with a larger glass placed farther from the table, and to make use of bits of leaf gold instead of papers; thinking, that this would succeed much better, so as perhaps to make the leaf gold rise and fall in spiral lines, or whirl for a time in the air, without touching either the table or glass.

It was ordered, that this experiment should be tried at the next meeting; and Mr. HOOKE promised to prepare it for that meeting.

Mr. OLDENBURG was desired to enquire by letter of Mr. NEWTON, whether he would consent, that a copy might be taken of his papers, for the better consideration of their contents.

Mr. OLDENBURG presented from Mr. MARTYN, the printer to the Society, Mr. WILUGHBY's *Ornithologia*, printed at London, 1676, in fol.

December 16. Mr. NEWTON's experiment of glass rubbed to cause various motions in bits of paper underneath, was tried, but did not succeed in those circumstances, with which it was tried. This trial was made upon the reading of a letter of his to Mr. OLDENBURG, dated at Cambridge, 14th December, 1675^m, in which he gives some more particular directions about that experiment.

The letter was as follows:

= Letter-book, vol. vii. p. 280.

The

"The notice you gave me of the Royal Society's intending to see the experiment of glass rubbed, to cause various motions in bits of paper underneath, put me upon recollecting myself a little further about it; and then remembering, that, if one edge of the brass hoop was laid downward, the glass was as near again to the table as it was when the other edge was laid downward, and that the papers played best when the glass was nearest to the table; I began to suspect, that I had set down a greater distance of the glass from the table than I should have done; for in setting down that experiment, I trusted to the idea I had of the bigness of the hoop, in which I might easily be mistaken, having not seen it of a long time. And this suspicion was increased by trying the experiment with an object glass of a telescope, placed about the third part of an inch from the table; for I could not see the papers play anything near so well as I had seen them formerly. Whereupon I looked for the old hoop with its glass, and at length found the hoop, the glass being gone; but by the hoop I perceived, that, when one edge was turned down, the glass was almost the third part of an inch from the table, and when the other edge was almost the inch which made the papers play so well, the glass was scarce the eighth part of an inch from the table. This I thought fit to signify to you, that, if the experiment succeed not well at the distance I set down, it may be tried at a less distance, and that you may alter my paper, and write in it the eighth part of an inch instead of $\frac{1}{2}$ or $\frac{2}{3}$ of an inch. The bits of paper ought to be very little, and of thin paper; perhaps little bits of the wings of a fly, or other light substances, may do better than paper. Some of the motions, as that of hanging by a corner and twirling about, and that of leaping from one part of the glass to another, without touching the table, happen but seldom; but it made me take the more notice of them.

"Pray present my humble service to Mr. Boyle, when you see him, and thank's for the favour of the converse I had with him at Spring. My conceit of trepaning the common rafter, as he was pleased to express it, makes me begin to have the better thoughts on that he was pleased to entertain it with a smile. I am apt to think, that when he has a set of experiments to try in his air-pump, he will make that one, to see how the compression or relaxation of a muscle will shrink or swell, soften or harden, lengthen or shorten it.

"As for registering the two discourses, you may do it; only I desire you would suspend till my next letter, in which I intend to set down something to be altered, and something to be added in the hypothesis."

It was ordered, that Mr. Oldenburg should again write to Mr. Newton, and acquaint him with the want of success of his experiment, and desire him to send his own apparatus, with which he had made it: as also to enquire, whether he had secured the papers being moved from the air, that might somewhere steal in.

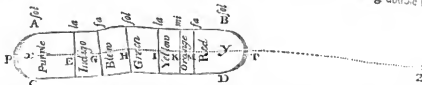
Hereupon the sequel of his hypothesis, the preceding meetings, was read to the end.

first part of which was read at the

"Thus

" Thus much of refraction, reflection, transparency, and opacity; and now to
 " explain colours; I suppose, that as bodies of various sizes, densities, or sensa-
 " tions, do by percussion or other action excite sounds of various tones, and
 " consequently vibrations in the air of various bigness; so when the rays of
 " light, by impinging on the stiff refracting superficies, excite vibrations in the
 " ether, those rays, whatever they be, as they happen to differ in magnitude,
 " strength or vigour, excite vibrations of various bigness; the biggest, strongest,
 " or most potent rays, the largest vibrations; and others shorter, according to
 " their bigness, strength, or power: and therefore the ends of the capillamenta of
 " the optic nerve, which pave or face the retina, being such refracting superfi-
 " cies, when the rays impinge upon them, they must there excite these vibra-
 " tions, which vibrations (like those of sound in a trunk or trumpet) will run
 " along the aqueous pores or crystalline pith of the capillamenta through the
 " optic nerves into the sensorium (which light itself cannot do) and there, I sup-
 " pose, affect the sense with various colours, according to their bigness and mix-
 " ture; the biggest with the strongest colours, reds and yellows; the least with
 " the weakest, blues and violets; the middle with green, and a confusion of
 " all with white, much after the manner, that in the sense of hearing, nature
 " makes use of aerial vibrations of several bignesses to generate sounds of divers
 " tones; for the analogy of nature is to be observed. And further, as the
 " harmony and discord of sounds proceed from the proportions of the aerial vi-
 " brations, so may the harmony of some colours, as of golden and blue, and the
 " discord of others, as of red and blue, proceed from the proportions of the æthe-
 " real. And possibly colour may be distinguished into its principal degrees, red,
 " orange, yellow, green, blue, indigo, and deep violet, on the same ground,
 " that sound within an eighth is graduated into tones. For, some years past, the
 " prismatic colours being in a well darkened room cast perpendicularly upon
 " a paper about two and twenty foot distant from the prism, I desired a friend
 " to draw with a pencil lines cross the image, or pillar of colours, where every
 " one of the seven aforementioned colours was most full and brisk, and also where he
 " judged the truest confines of them to be, whilst I held the paper so, that the said
 " image might fall within a certain compass marked on it. And this I did, partly
 " because my own eyes are not very critical in distinguishing colours, partly be-
 " cause another, to whom I had not communicated my thoughts about this mat-
 " ter, could have nothing but his eyes to determine his fancy in making those
 " marks. This observation we repeated divers times, both in the same and dis-
 " vers days, to see how the marks on several papers would agree; and comparing
 " the observations, though the just confines of the colours are hard to be assigned,
 " because they pass into one another by insensible gradation; yet the differences
 " of the observations were but little, especially towards the red end, and taking
 " means between those differences, that were, the length of the image (reckoned
 " not by the distance of the verges of the semicircular ends, but by the distance of
 " the centres of those semicircles, or length of the straight sides as it ought to be)
 " was divided in about the same proportion that a string is, between the end and
 " the middle, to sound the tones in the eighth. You will understand the best
 " by viewing the annexed figure, in which A B and C D represent the straight
 " sides, about ten inches long, A B C and B T D the semicircular ends, X and Y

" Y the centres of those semicircles, XZ the length of a musical string double to

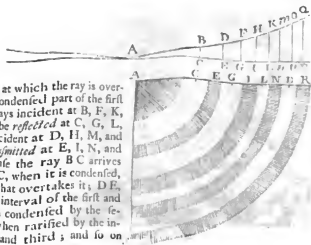


" X Y, and divided between X and Y, so as to sound the tones expressed at the side (that is X H the half, X G and G I the third part, Y K the fifth part, Y M the eighth part, and G E the ninth part of X Y) and the intervals between these divisions express the spaces which the colours written there took up, every colour being most briskly specific in the middle of those spaces.

" Now for the cause of these and such like colours made by refraction, the biggest or strongest rays must penetrate the refracting superficies more freely and easily than the weaker, and so be less turned awry by it, that is, less refracted; which is as much as to say, the rays, which make red, are least refrangible, those, which make blue and violet, most refrangible, and others otherwise refrangible according to their colour: whence, if the rays, which come promiscuously from the sun, be refracted by a prism, as in the aforesaid experiment, these of several sorts being variously refracted, must go to several places on an opposite paper or wall, and so parted, exhibit every one their own colours, which they could not do while blended together. And, because refraction only severs them, and changes not the bigness or strength of the ray, thence it is, that after they are once well severed, refraction cannot make any further changes in their colour.

" On this ground may all the phenomena of refractions be understood: but to explain the colours made by reflections, I must further suppose, that, though light be unimaginably swift, yet the æthereal vibrations, excited by a ray, move faster than the ray itself, and so overtake and outrun it one after another. And this, I suppose, they will think an allowable supposition, who have been inclined to suspect, that these vibrations themselves might be light. But to make it the more allowable, it is possible light itself may not be so swift, as some are apt to think; for, notwithstanding any argument, that I know yet to the contrary, it may be an hour or two, if not more, in moving from the sun to us. This celerity of the vibrations therefore supposed, if light be incident on a thin skin or plate of any transparent body, the waves, excited by its passage through the first superficies, overtaking it one after another, till it arrive at the second superficies, will cause it to be there reflected or refracted accordingly as the condensed or expanded part of the wave overtakes it there. If the plate be of such a thickness, that the condensed part of the first wave overtake the ray at the second superficies, it must be reflected there; if double that thickness, that the following rarified part of the wave, that is, the space between that and the next wave,

“ wave, overtake it, there it must be transmitted; if triple the thickness, that the
 “ condensed part of the second wave overtake it, there it must be reflected, and
 “ so where the plate is five, seven, or nine times that thickness, it must be reflected
 “ by reason of the third, fourth, or fifth wave, overtaking it at the second super-
 “ ficies; but when it is four, six, or eight times that thickness, so that the ray
 “ may be overtaken there by the dilated interval of those waves, it shall be *trans-*
 “ *mitted*, and so on; the second superficies being made able or unable to reflect
 “ accordingly as it is condensed or expanded by the waves. For instance, let
 “ A H Q represent the superficies of a spherically convex glass laid upon a plain
 “ glass A I R, and A I R Q H the thin plane-concave plate of air between them,
 “ and B C, D E, F G, H I, &c. thicknesses of that plate, or distances of the
 “ glasses in the arithmetical progression of the numbers 1. 2. 3. 4. &c. whereof



“ B C is the distance, at which the ray is over-
 “ taken by the most condensed part of the first
 “ wave: I say, the rays incident at B, F, K,
 “ and O, ought to be reflected at C, G, L,
 “ and P, and those incident at D, H, M, and
 “ Q, ought to be transmitted at E, I, N, and
 “ R; and this, because the ray B C arrives
 “ at the superficies A C, when it is condensed,
 “ by the first wave that overtakes it, D E,
 “ when rarified by the interval of the first and
 “ second; F G, when condensed by the se-
 “ cond wave; H I, when rarified by the in-
 “ terval of the second and third; and so on

“ for an indeterminate number of successions; and at A, the center or contact of
 “ the glasses, the light must be transmitted, because there the æthereal mediums
 “ in both glasses are continued as if but one uniform medium. Whence, if the
 “ glasses in this posture be looked upon, there ought to appear at A, the contact
 “ of the glasses, a black spot, and about that many concentric circles of light and
 “ darkness, the squares of whose semidiameters are to be in arithmetical pro-
 “ gression. Yet all the rays, without exception, ought not to be thus reflected or
 “ transmitted: for sometimes a ray may be overtaken at the second superficies,
 “ by the vibrations raised by another collateral or immediately succeeding ray;
 “ which vibration, being as strong or stronger than its own, may cause it to be
 “ reflected or transmitted when its own vibration alone would do the contrary.
 “ And hence some little light will be reflected from the black rings, which makes

"them rather black than totally dark; and some transmitted at the lucid rings, which makes the black rings, appearing on the other side of the glasses, not so black as they would otherwise be. And so at the central black spot, where the glasses do not absolutely touch, a little light will be reflected, which makes the spot darkest in the middle, and only black at the verges. For thus I have observed it to be, by tying very hard together two glass prisms, which were accidentally (one of them at least) a very little convex, and viewing by divers lights this black spot at their contact. If a white paper was placed at a little distance behind a candle, and the candle and paper viewed alternately by reflection from the spot, the verges of the spot, which looked by the light of the paper as black as the middle part, appeared by the stronger light of the lucid enough, so as to make the spot seem less than before; but the middle part continued as absolutely black in one case as in the other, some specks and streaks in it only excepted, where I suppose the glasses, through some unevenness in the polish, did not fully touch. The same I have observed by viewing the spot by the like reflection of the sun and clouds alternately.

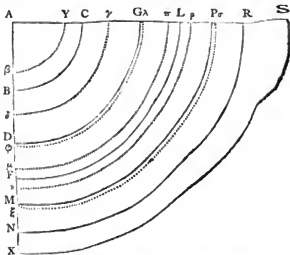
"But to return to the lucid and black rings, those rings ought always to appear after the manner described, were light uniform. And after that manner, when the two contiguous glasses A Q and A R have been illustrated, in a dark room, by light of any uniform colour made by a prism, I have seen the lucid circles appear to about twenty in number, with many dark ones between them, the colour of the lucid ones being that of the light, with which the glasses were illustrated. And if the glasses were held between the eye and prismatic colours, cast on a sheet of white paper, or if any prismatic colour was directly trajected through the glasses to a sheet of paper placed a little way behind, there would appear such other rings of colour and darkness (in the first case between the glasses, in the second, on the paper) oppositely corresponding to those, which appeared by reflection: I mean, that, whereas by reflected light there appeared a black spot in the middle, and then a coloured circle; on the contrary, by transmitted light there appeared a coloured spot in the middle, and then a black circle, and so on; the diameters of the coloured circles, made by transmission, equaling the diameters of the black ones made by reflection.

"Thus, I say, the rings do and ought to appear when made by uniform light; but in compound light it is otherwise. For the rays, which exhibit red and yellow, exciting, as I said, larger pulses in the ether than those, which make blue and violet, and consequently making bigger circles in a certain proportion, as I have manifestly found they do, by illuminating the glasses successively by the aforesaid colours of prism in a well darkened room, without changing the position of my eye or of the glasses; hence the circles, made by illustrating the glasses with white light, ought not to appear black and white by turns, as the circles made by illustrating the glasses; for instance, with red light, appear red and black; but the colours, which compound the white light, must display themselves by being reflected, the blue and violet nearer to the center than the red and yellow, whereby every lucid circle must become violet in the inward verge, red in the outward, and of intermediate colours in the intermediate parts.

M m

parts, and be made broader than before, spreading the colours both ways into those spaces, which I call the black rings, and which would here appear black, were the red, yellow, blue, and violet, which make the verge of the rings, taken out of the incident white light, which illustrates the glasses, and the green only left to make the lucid rings. Suppose C B, G D, L F, P M, R N, S X, represent quadrants of the circles made in a dark room by the very deepeft prism.

matic red alone; and Y β , γ ,
 λ ϕ , π μ , ρ ν , σ ξ , the qua-
 drants of like circles made
 also in a dark room, by the
 very deepeft prismatic violet
 alone: and then, if the glass-
 es be illuminated by open
 day light, in which all sorts
 of rays are blended, it is ma-
 nifest, that the first lucid
 ring will be Y β B C; the sec-
 ond γ δ D G, the third,
 λ ϕ F L, the fourth π μ M P,
 the fifth ρ ν N R, the sixth
 σ ξ X S, &c. in all which
 the deepeft violet must be
 reflected at the inward edges
 represented by the pricked
 lines, where it would be re-
 flected were it alone, and the deepeft red at the outward edges represented by
 the black lines, where it would be reflected, were it alone; and all intermediate
 colours at those places, in order, between these edges, at which they would be re-
 flected were they alone; each of them in a dark room, parted from all other
 colours by the refraction of a prism. And because the squares of the semidia-
 meters of the outward verges A C, A G, A L, &c. as also of A Y, A γ , A λ ,
 &c. the semidiameters of the inward are in arithmetical progression of the num-
 bers 1, 3, 5, 7, 9, 11, &c. and the squares of the inward are to the squares
 of the outward (A Y² to A C², A γ ² to A G², A λ ² to A L², &c.) as 9 to 14,
 (as I have found by measuring them carefully and often, and comparing the
 observations:) therefore the outward red verge of the second ring, and inward
 violet one of the third, shall border upon one another (as you may know by com-
 putation, and see them represented in the figure) and the like edges of the third
 and fourth rings shall interfere, and those of the fourth and fifth interfere more,
 and so on. Yea, the colours of every ring must spread themselves something
 more both ways than is here represented, because the quadrantal arcs here de-
 scribed represent not the verges, but the middle of the rings made in a dark
 room by the extreme violet and red; the violet falling on both sides the pricked
 arches, and red on both sides the black line arches. And hence it is, that
 these rings or circuits of colours succeed one another continually, without any
 inter-



"intervening black, and that the colours are pure only in the three or four first rings, and then intervening and mixing more and more, dilute one another so much, that after eight or nine rings they are no more to be distinguished, but seem to constitute an even whiteness; whereas, when they were made in a dark room by one of the prismatic colours alone, I have, as I said, seen above twenty of them, and without doubt could have seen them to a greater number, had I taken the pains to make the prismatic colour more uncompounded. For by unfolding these rings from one another, by certain refractions expressed in the other papers I send you, I have, even in day-light, discovered them to above an hundred; and perhaps they would have appeared innumerable, had the light or colour illustrating the glasses been absolutely uncompounded, and the pupil of my eye but a mathematical point; so that all the rays, which came from the same point of the glass might have gone into my eye at the same obliquity to the glass.

"What has been hitherto said of the rings, is to be understood of their appearance to an unmoved eye: but if you vary the position of the eye, the more obliquely you look on the glass, the larger the rings appear. And of this the reason may be, partly that an oblique ray is longer in passing through the first superficies, and so there is more time between the waving forward and backward of that superficies, and consequently a larger wave generated, and partly, that the wave in creeping along between the two superficies may be impeded and retarded by the rigidity of those superficies, bounding it at either end, and so not overtake the ray so soon as a wave, that moves perpendicularly cross.

"The bigness of the circles made by every colour, and at all obliquities of the eye to the glasses, and the thickness of the air, or intervals of the glasses, where each circle is made, you will find expressed in the other papers I send you; where also I have more at large described, how much these rings interfere, or spread into one another; what colours appear in every ring, where they are most lively, where and how much diluted by mixing with the colours of other rings; and how the contrary colours appear on the back side of the glasses by the transmitted light, the glasses transmitting light of one colour at the same place, where they reflect that of another. Nor need I add any thing further of the colours of other thinly plated mediums, as of water between the aforesaid glasses, or formed into bubbles, and so encompassed with air, or of glass blown into very thin bubbles at a lamp furnace, &c. the case being the same in all these, excepting that, where the thickness of the plate is not regular, the rings will not be so; that in plates of denser transparent bodies, the rings are made at a less thickness of the plate (the vibrations, I suppose, being shorter in rarer rather than in denser) and that in a denser plate, surrounded with a rarer body, the colours are more vivid than in the rarer surrounded with the denser; as, for instance, more vivid in a plate of glass surrounded with air, than in a plate of air surrounded with glass; of which the reason is, that the reflection of the second superficies, which causes the colours, is, as was said above, stronger in the former.

Obs. 24.

M m 2

mer

"mer case than in the latter: for which reason also the colours are most vivid,
 "when the difference of the density of the medium is greatest.

"Of the colours of natural bodies also I have said enough in those papers, shewing how the various sizes of the transparent particles, of which they consist, are sufficient to produce them all, those particles reflecting or transmitting this or that sort of rays, according to their thickness, like the aforesaid plates, as if they were fragments thereof. For, I suppose, if a plate of an even thickness, and consequently of an uniform colour, were broken into fragments of the same thickness with the plate, a heap of those fragments would be a powder much of the same colour with the plates. And so, if the parts be of the thickness of the same water in the black spot at the top of a bubble described in the seventeenth of the observations I send you, I suppose the body must be black. In the deduction of which blackness, I suppose, that the particles of that size being posed to reflect almost no light outward, but to refract it continually in its passage from every part to the next; by this multitude of refractions, they are kept so long straggling to and fro within the body, till at last almost all impinge on the solid parts of the body, and so are stopped and stifled; those parts having no sufficient elasticity, or other disposition to return nimbly enough the smart shock of the ray back upon it.

"I should here conclude, but that there is another strange phenomenon of colours, which may deserve to be taken notice of. Mr. Hooke, you may remember, was speaking of an odd straying of light, caused in its passage near the edge of a razor, knife, or other opaque body in a dark room; the rays, which pass very near the edge, being thereby made to stray at all angles into the shadow of the knife.

"To this Sir WILLIAM PETTY, then president, returned a very pertinent query, "Whether that straying was in curve lines? and that made me, having heard Mr. Hooke some days before compare it to the straying of sound into the quietest medium, say, that I took it to be only a new kind of refraction, caused perhaps by the external æther's beginning to grow rarer a little before it came at the opaque body, than it was in free spaces; the denser æther without the body, and the rarer within it, being terminated not in a mathematical superficies, but passing into one another through all intermediate degrees of density: whence the rays, that pass so near the body, as to come within that compass, where the outward æther begins to grow rarer, must be refracted by the uneven denseness thereof, and blended inwards toward the rarer medium of the body. To this Mr. Hooke was then pleased to answer, that though it should be but a new kind of refraction, yet it was a new one. What to make of this unexpected reply, I knew not; having no other thoughts, but that a new kind of refraction might be as noble an invention as any thing else about light; but it made me afterwards, I know not upon what occasion, happen to say, among some that were present to what passed before, that I thought I had seen the experiment before in some Italian author. And the author is HONORATUS FABER, in his dialogue De Lumine, who had it from GRIMALDO; whom

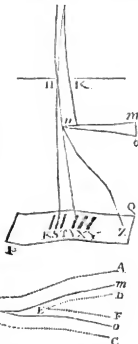
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"whom I mention, because I am to describe something further out of him, which
 "you will apprehend by this figure: suppose the sun shine through the little hole
 "HK into a dark room upon the paper PQ, and with a wedge MNO intercept
 "all but a little of that beam, and you will see
 "upon the paper six rows of colours, R, S, T,
 "V, X, Y, and beyond them a very faint light
 "spreading either way, such as rays broken, like
 "HNZ, must make. The author describes it
 "more largely in divers schemes. I have time
 "only to hint the sum of what he says.

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"Now for the breaking of the ray HNZ, sup-
 "pose, in the next figure MNO be the solid
 "wedge, ABC the inward bound of the uniform
 "rater ether within, between which bounds the
 "ether runs through all the intermediate degrees,
 "and it is manifest, that, if a ray come between
 "B and N, it must in its passage there bend from
 "the denser medium towards C, and that so much
 "the more, by how much it comes nearer N. Fur-
 "ther, for the three rows of colours VXY, those
 "may perhaps proceed from the number of vibra-
 "tions (whether one, two, or three) which over-
 "take the ray in its passage from G, which over-
 "take the mid-way between G and H, till it be about
 "the nearest distance to N, so as to touch the circle
 "described about N, with that distance, by the
 "last of which vibrations, expanding or con-
 "tracting the medium there, the ray is licensed
 "to recede again from N, and go on to make the
 "colours; or further bent about N, till the inter-
 "val of the next wave overtake it, and give it li-
 "berty to go from N, very nearly in the line it is
 "then moving, suppose toward Z, to cause the faint light spoken of above, you
 "will understand me a little better, by comparing this with what was said of the
 "colours of thin transparent plates, comparing this with what was said of the
 "goes from GBH towards N, to the thickness of one of those plates. Some-
 "thing too there is in Des CARTES's explication of the rainbow's colours, which
 "would give further light in this. But I have no time left to insist further upon
 "particulars; nor do I propound this without diffidence, having not made suffi-
 "cient observation about it."



After reading this discourse, Mr. HOOKE said, that the main of it was concerned
 in his *Micrographia*, which Mr. NEWTON had only carried farther in some parti-
 culars.

The Society adjourned till December 30.

Decem.

December 30. There was read a letter to Mr. OLDENBURG from Mr. NEWTON, dated at Cambridge 21st December, 1675, in answer to what had been written to him by Mr. OLDENBURG concerning the want of success of his experiment made with a glass rubbed, &c. This letter was as follows :

" Upon your letter I took another glass four inches broad, and one fourth of an inch thick, of such glass as telescopes are made of, and placed it a one sixth part of an inch from the table. It was set in such a piece of wood, as the object-glasses of telescopes use to be set in : and the experiment succeeded well. After the rubbing was still, and all was still, the motion of the papers would continue sometimes while I counted a hundred, every paper leaping up about twenty times more or less, and down as often. I tried it also with two other glasses that belong to a telescope, and it succeeded with both ; and I make no question but any glass will do that, if it be excited to electric virtue, as I think any may. If you have a mind to any of these glasses, you may have them ; but I suppose, if you cannot make it do in other glass, you will fail in any I can send you. I am apt to suspect the failure was in the manner of rubbing ; for I have observed, that the rubbing variously, or with various things, alters the case. At one time I rubbed the aforesaid great glass with a napkin, twice as much as I used to do with my gown, and nothing would stir ; and yet presently rubbing it with something else, the motions soon began. After the glass has been much rubbed too, the motions are not so lasting ; and the next day I found the motions fainter and difficulter to excite than the first. If the Society have a mind to attempt it any more, I can give no better advice than this : to take a new glass not yet rubbed (perhaps one of the old ones may do well enough after it has lain still a while) and let this be rubbed, not with linen, nor soft nappy woolen, but with stuff, whose threads may rake the surface of the glass, suppose tamarine, or the like, doubled up in the hand, and this with a brisk motion as may be, till an hundred or an hundred and fifty may be counted, the glass lying all the while over the papers. Then, if nothing stir, rub the glass with the finger ends half a score of times to and fro, or knock your finger ends as often upon the glass ; for this rubbing or knocking with your fingers, after the former rubbing, conduces most to excite the papers. If nothing stir yet, rub again with the cloth till sixty or eighty may be counted, and then rub or knock again with your fingers, and repeat this till the electric virtue of the glass be so far excited as to take up the papers, and then a very little rubbing or knocking now and then will revive the motions. In doing all this, let the rubbing be always done as nimbly as may be ; and if the motion be circular, like that of glass grinding, it may do better. But if you cannot make it yet succeed, it must be let alone till I have some opportunity of trying it before you. As for the suspicion of the papers being moved by the air, I am secure from that ; yet in the other, of drawing leaf-gold to above a foot distance, which I never went about to try myself till the last week, I suspect the air might raise the gold, and then a small attraction might determine it towards the glass ; for I could not make it succeed."

1674.]

It was ordered, that Mr. NEWTON's directions in this letter should be observed in the experiment to be made at the next meeting of the Society.

Mr. OLDENBURG read a letter to himself from Mr. JOHN GASCOIGNE, dated at Liege, 15th December, 1675⁶, acquainting him with the death of Mr. LINUS of the epidemical disease, which then raged through so many countries, and with the resolution of Mr. LINUS's disciples, to try Mr. NEWTON's experiment concerning light and colours more clearly and carefully, and before more witnesses, according to the directions given them by Mr. NEWTON's last letter: intimating withal, that if the said experiment be made before the Royal Society, and be attested by them to succeed, as Mr. NEWTON affirmed, they would rest satisfied.

It was ordered, that when the sun should serve, the experiment should be made before the Society.

Mr. AUBREY presented the Society with his observations made in Wiltshire, which being read, he was desired to endeavour to procure some of the iron-ore of Seint in that county, said to be so rich, that the smith could melt it in his forge: as also to procure from Eaton-Peires in Malmesbury hundred, some of the blue clay, free from sand, and almost of the colour of ultramarine; which clay Mr. DOUGHT supposed to be very fit for porcelain.

The Society adjourned till the 13th of January following.

January 13. Captain HENRY SHEERES, JOHN MAPLETOFT, M. D. ⁷, and Signor FRANCISCO TRAVAGINI were proposed candidates, the first in the name of Sir JOSEPH WILLIAMSON, the second by Mr. Hooke, and the third by Mr. OLDENBURG.

Mr. NEWTON's experiment of glass rubbed, to cause various motions in bits of paper underneath, being made according to his more particular directions, succeeded very well. The rubbing was made both with a scrubbing brush, made of short hog's bristles, with a knife, the haft of the knife made of whalebone, and with the nail of one's finger. It appeared, that touching many parts at once with a hard and rough body, produced the effect expected.

It was ordered, that Mr. NEWTON should have the thanks of the Society, for giving himself the trouble of imparting to them such full instructions for making the experiment.

Mr. OLDENBURG produced and read a Latin letter of Mr. FLAMSTEAD to Sir JONAS MOORE, dated at Greenwich, 24th December, 1675⁷, containing an account of his observations made of the late eclipse of the moon on the 21st December, p. m.

⁶ Letter-book. vol. vi. p. 282.

⁷ Professor of physics at Gresham College.

⁸ It is printed in the Philosoph. Transact. vol. x. p. 121. p. 495.

It was ordered, that Mr. OLDENBURG should be desired, according to the motion made by Mr. FLAMSTEAD, to impart these observations to Signor CASSINI at Paris, and to desire him to communicate to the Society his observations on the same eclipse.

Mr. OLDENBURG produced likewise some papers of Mr. AUBREY, containing his observations of the county of Surrey. But the time being elapsed, these papers were referred to the next meeting.

January 20. Mr. AUBREY's papers of observations on Surrey were read.

There was also read the beginning of Mr. NEWTON's discourse, containing such observations, as conduce to further discoveries for completing his theory of light and colours, especially as to the constitution of natural bodies, on which their colours or transparency depend: in which he describes first the principal of his observations, and then considers and makes use of them.

At this time there were read the first fifteen of those observations as follow:

"I suppose you understand, that all transparent substances (as glass, water, air, &c.) when made very thin by being blown into bubbles, or otherwise formed into plates, do exhibit various colours, according to their various thinness, although at a greater thickness they appear very clear and colourless. In my former discourse about the constitution of light, I omitted these colours, because they seemed of a more difficult consideration, and were not necessary for the establishing of the doctrine, which I propounded; but because they may conduce to further discoveries for completing that theory, especially as to the constitution of the parts of natural bodies, on which their colours or transparency depend, I have now sent you an account of them. To render this discourse short and distinct, I have first described the principal of my observations, and then considered and made use of them. The observations are these:

"Obs. 1. Compressing two prisms hard together, that their sides (which by chance were a very little convex) might somewhere touch one another, I found the place, in which they touched, to become absolutely transparent, as if they had been there one continued piece of glass; for when the light fell so obliquely on the air, which in other places was between them, as to be all reflected, in that place of contact it seemed wholly transmitted; inasmuch that when looked upon, it appeared like a black or dark spot, by reason of no sensible light was reflected from thence, as from other places; and when looked through, it seemed, as it were, a hole in that air, that was formed into a thin

* Reciter, vol. v. p. 89.

"Note, that there is some light reflected from those parts of this black spot, where the glasses, by reason of their convexity, and some little unevenness of their surfaces, do not come so absolutely contact. For by viewing the sun, by re-

"Action from this spot, not only the verges of it became so loud, but diverse local vains, as I speak, appeared in the midst of the blackness: but yet some parts of the spot seemed still as black as before, which parts I take to be those, where the glasses touched.

1672.]

“ plate by being compressed between the glasses; and through this hole objects that were beyond, might be seen distinctly, which could not at all be seen through other parts of the glasses, where the air was interjacent. Although the glasses were a little convex, yet this transparent spot was of a considerable breadth, which breadth seemed principally to proceed from the yielding inwards of the parts of the glasses by reason of their mutual pressure; for by pressing them very hard together, it would become much broader than otherwise.

“ Obs. 2. When the plate of air, by turning the prisms about their common axis, became so little inclined to the incident rays, that some of them began to be transmitted, there arose in it many slender arcs of colours, which at first were shaped almost like the conchoid, as you see them here delineated. And by continuing the motion of the prisms, these arcs increased and bended more and more about the said transparent spot, till they were completed into circles or rings encompassing it, and afterwards continually grew more and more contracted.

Fig. I.



“ These arcs, at their first appearance, were of a violet and blue colour, and between them were white arcs of circles, which presently became a little tinged in their inward limbs with red and yellow, and to their outward limbs the blue was adjacent; so that the order of these colours from the central dark spot, was at that time white, blue, violet, black, red, orange, yellow, white, blue, violet, &c. but the yellow and red were much fainter than the blue and violet.

“ The motion of the prisms about their axis being continued, these colours contracted more and more, shrinking towards the whiteness on either side of it, until they totally vanished into it; and then the circles in those parts appeared black, and white, without any other colours intermixed; but by further moving the prisms about, the colours again emerged out of the whiteness, the violet and blue at its inward limb, and at its outward limb the red and yellow; so that now their order from the central spot was white, yellow, red, black, violet, blue, white, yellow, red, &c. contrary to what it was before.

“ Obs. 3. When the rings or some parts appeared only black and white, they were very distinct and well defined, and the blackness seemed as intense as that of the central spot; also, in the borders of these rings, where the colours began to emerge out of the whiteness, they were pretty distinct, which made them visible to a very great multitude. I have sometimes numbered above thirty successions (reckoning every black and white ring for one succession) and seen more of them, which by reason of their smallness I could not number. But in other positions of the prisms, at which the rings appeared of many colours, I could not distinguish above eight or nine of them, and the exterior of those too were confused and dilute.

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" In these two observations, to see the rings distinct, and without any other colour
 " but black and white, I found it necessary that I held my eye at a good distance
 " from them. For by approaching nearer, although in the same inclination, of
 " my eye, yet there emerged a bluish colour out of the white, which by distancing
 " myself more and more into the black, rendered the circles less distinct, and
 " the white a little tinged with red and yellow. I found also, that by looking
 " through a slit or oblong hole, which was narrower than the pupil of my eye,
 " and held close to it parallel to the prisms, I could see the circles much distincter
 " and visible to a far greater number than otherwise.

" Obf. 4. To observe more nicely the order of the colours, which arose out of
 " the white circles, as the rays became less and less inclined to the plate of air; I
 " took two object-glasses, the one a plane-convex for a fourteen foot telescope,
 " and the other a large double convex for one of fifty foot; and upon this lay-
 " ing the other with its plane side downwards, I pressed them slowly together,
 " to make the colours successively emerge in the middle of the circles, and then
 " slowly lifted the upper glass from the lower, to make them successively vanish
 " again in the same place, where being of a considerable breadth, I could more
 " easily discern them. And by this means I observed their succession and quan-
 " tity to be as followeth.

" Next to the pellucid central spot made by the contact of the glasses, suc-
 " ceeded violet, blue, white, yellow, and red. The violet and blue were so very
 " little in quantity, that I could not discern them in the circles made by the
 " prisms; but the yellow and red were pretty copious, and seemed about as much
 " in extent as the white, and four or five times more than the blue and violet.
 " The next circuit or order of colours immediately encompassing these was vio-
 " let, blue, green, yellow, and red. And these were all of them copious and
 " vivid, excepting the green, which was very little in quantity, and seemed much
 " more faint and dilute than the other colours. Of the other four the violet
 " was least, and the blue less than the yellow or red. The third circuit or order
 " was also purple, blue, green, yellow, and red, in which the purple seemed more
 " reddish than the violet in the former circuit, and the green was much more
 " conspicuous, being as brisk and copious as any of the other colours except the
 " yellow; but the red began to be a little faded, inclining very much to purple.
 " After these succeeded green and red: the green was very copious and lively, in-
 " clining on the one side to blue, and the other to yellow. But in this fourth
 " circuit there was neither violet, blue, nor yellow, and the red was very imper-
 " fect and dirty. Also the succeeding colours became more and more imperfect
 " and dilute, till after three or four more revolutions they ended in perfect white-
 " ness.

" Obf. 5. To determine the interval of the glasses, or thickness of the interja-
 " cent air, by which each colour was produced; I measured the diameter of the
 " first six rings at the most luid part of their orbits, and squaring them I found
 " their squares to be in arithmetical progression of the odd numbers, 1. 3. 5. 7.
 " 9. And since one of the glasses was plane and the other spherical, their
 " intervals

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" intervals at those rings must be in the same progression. I measured also the diameters of the dark or faint rings between the more lucid colours, and found their squares to be in arithmetical progression, of the even numbers 2, 4, 6, 8, 10, 12; and it being very nice and difficult to take these measures exactly, I repeated them divers times, at divers parts of the glasses, that by their agreement I might be confirmed in them; and the same method I used in determining some others of the following observations.

" Obs. 6. The diameter of the first ring, at the most lucid part of its orbit, was $\frac{7}{16}$ parts of an inch, and the diameter of the sphere, on which the double convex object-glass was ground, was an hundred and two foot, as I found by measuring it; and consequently the thickness of the air, or aerial interval of the glasses at that ring, was $\frac{1}{16}$ of an inch. For as the diameter of the said sphere (an hundred and two foot, or twelve hundred and twenty-four inches) is to the semidiameter of the ring $\frac{7}{16}$, so very nearly is that semidiameter to $\frac{1}{16}$, the said distance of the glasses. Now, by the precedent observation to this, the eleventh part of this distance ($\frac{1}{16}$) is the thickness of the air at that part of the first ring, where the yellow would be most vivid, were it not mixed with other colours in the white; and this doubled gives the difference of its thickness at the yellow in all the other rings, viz. $\frac{1}{8}$, or, to use a round number, the eighty thousand part of an inch.

" Obs. 7. These dimensions were taken, when my eye was placed perpendicularly over the glasses, in or near the axis of the rings; but when I viewed them obliquely, they became bigger, continually swelling as I removed my eye farther from their axis; and partly by measuring the diameter of the same ring at several obliquities of my eye, partly by other means; as also by making use of the two prisms for very great obliquities, I found its diameter, and consequently the thickness of the air at its perimeter in all those obliquities, to be very nearly in the proportions expressed in this table.

Incidence on the air.		Refraction into the air.		Diameter of the ring.	Thickness of the air.
gr.	min.	gr.	min.		
00	00	00	00	10	10
6	26	10	00	$10\frac{1}{2}$	$10\frac{1}{2}$
12	45	20	00	$10\frac{1}{4}$	$10\frac{1}{4}$
18	49	30	00	$10\frac{1}{8}$	$11\frac{1}{8}$
24	30	40	00	$11\frac{1}{4}$	13
29	37	50	00	$12\frac{1}{2}$	$15\frac{1}{2}$
33	58	60	00	14	20
35	47	65	00	$15\frac{1}{2}$	$23\frac{1}{2}$
37	19	70	00	$16\frac{1}{2}$	28
38	33	75	00	$19\frac{1}{2}$	37
39	17	80	00	$22\frac{1}{2}$	$52\frac{1}{2}$
40	00	85	00	29	84
40	11	90	00	35	$122\frac{1}{2}$

N^o 2

In

" In the two first columns are expressed the obliquities of the rays to the plate
 " of air; that is, their angles of incidence and refraction. In the third column,
 " the diameter of any coloured ring of those obliquities is expressed in parts, of
 " which ten constitute that diameter, when the rays are perpendicular. And in
 " the fourth column the thickness of the air at the circumference of that ring is
 " expressed in parts, of which also ten constitute that thickness, when the rays
 " are perpendicular.

" Obs. 8. The dark spot in the middle of the rings increased also by that
 " obliquation of the eye, although almost insensibly. But, if instead of the
 " object-glasses, the prisms were made use of, its increase was more manifest, when
 " viewed so obliquely, that no colours appeared about it. It was least, when the
 " rays were incident most obliquely on the interjacent air, and increased more and
 " more, until the coloured rings appeared, and then decreased again, but not so
 " much as it increased before. And hence it is evident, that the transparency
 " was not only at the absolute contact of the glasses, but also where they had some
 " little interval. I have sometimes observed the diameter of that spot to be be-
 " tween half and two fifth parts of the diameter of the exterior circumference of
 " the red in the first circuit or revolution of colours, when viewed almost
 " perpendicularly; whereas, when viewed obliquely, it hath wholly vanished,
 " become opaque and white, like the other parts of the glass. Whence it
 " be collected, that the glasses did then scarcely, or not at all, touch one
 " another; and that their interval of the petimeter of that spot, when viewed
 " perpendicularly, was about a fifth or sixth part of their interval at the circum-
 " ference of the said red.

" Obs. 9. By looking through the two contiguous object-glasses, I found, that
 " the interjacent air exhibited rings of colours, as well by transmitting light as
 " by reflecting it. The central spot was now white, and from it the order of
 " the colours were yellowish, red, black, violet, blue, white, yellow, red;
 " violet, blue, green, yellow, red, &c. but these colours were very faint and
 " dilute, unless when the light was trajected very obliquely through the glasses;
 " for by that means they became pretty vivid, only the first yellowish red, like
 " the blue in the fourth observation, was so little and faint as scarcely to be dis-
 " cerned. Comparing the coloured rings made by reflection with these made by
 " transmission of the light, I found, that white was opposite to black, red to blue,
 " yellow to violet, and green to a compound of red and violet; that is, those
 " parts of the glass were black when, looked through, which when looked upon
 " appeared white, and on the contrary; and so those, which in one case exhibited
 " blue, did in the other case exhibit red; and the like of the other colours.

" Obs. 10. Wetting the object-glass a little at their edges, the water crept in
 " slowly between them, and the circles thereby became less, and the colours
 " more faint; insomuch that, as the water crept along, one half of them, at which
 " it first arrived, would appear broken off from the other half, and contracted
 " into a less room. By measuring them I found the proportion of their diameters
 " to the diameters of the like circles made by air, to be about seven to eight;
 " and

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"and consequently the intervals of the glasses at like circles, caused by these two mediums, water and air, are as about three to four. Perhaps it may be a general rule, that if any other medium, more or less dense than water, be compressed between the glasses, their interval at the rings, caused thereby, will be to their interval, caused by interjacent air, as the sines are, which measure the refraction made out of that medium into air.

"Obs. 11. When the water was between the glasses, if I pressed the upper glass variously at its edges to make the rings move nimbly from one place to another, a little bright spot would immediately follow the center of them, which, upon creeping in of the ambient water into that place, would presently vanish. Its appearance was such, as interjacent air would have caused, and it exhibited the same colours; but it was not air, for where any aerial bubbles were in the water they would not vanish. The refraction must rather have been caused by a subtiler medium, which could recede through the glass at the creeping in of the water.

"Obs. 12. These observations were made in the open air. But further, to examine the effects of coloured light falling on the glasses, I darkened the room, and viewed them by reflection of the colours of a prism cast on a sheet of white paper; and by this means the rings became distincter, and visible to a far greater number than in the open air.

"I have seen more than twenty of them, whereas in the open air I could not discern above eight or nine.

"Obs. 13. Appointing an assistant to move the prism to and fro about its axis, that all its colours might successively fall on the same place of the paper, and be reflected from the circles to my eye whilst I held it immovable; I found the circles, which the red light made, to be manifestly bigger than those, which were made by the blue and violet; and it was very pleasant to see them gradually swell or contract, accordingly as the colour of the light was changed. The interval of the glass at any of the rings, when they were made by the utmost red light, was to their interval at the same ring, when made by the utmost violet, greater than three to two, and less than thirteen to eight. By the most of my observations it was as nine to fourteen. And this proportion seemed very nearly the same in all obliquities of my eye, unless when two prisms were made use of instead of the object-glasses: for then, at a certain great obliquity, the rings made by the several colours seemed equal; and, at a greater obliquity, those made by the violet would be greater than the same rings made by the red.

"Obs. 14. While the prism was turned about uniformly, the contraction or dilatation of a ring made by all the several colours of the prism successively reflected from the object-glasses, was swiftest in the red, slowest in the violet, and in intermediate colours it had intermediate degrees of celerity. Comparing the extent, which each colour obtained by this contraction or dilatation, I found, that

“ that the blue was sensibly more extended than the violet, the yellow than the blue, and the red than the yellow. And, to make a juster estimation of their proportions, I observed, that the extent of the red was almost double to that of the violet, and that the light was of a middle colour between yellow and green at that interval of the glasses, which was an arithmetical mean between the two extremes; contrary to what happens in the colours made by the fraction of a prism, where the red is most contracted, the violet most expanded, and in the midst of them is the confine of green and blue.

“ Obs. 15. These rings were not of various colours, like those in the open air, but appeared all over of that prismatic colour only, with which they were illuminated: and, by projecting the prismatic colours immediately upon the glasses, I found, that the light, which fell on the dark spaces, which were between the coloured rings, was transmitted through the glasses without any variation of colour. For, on a white paper placed behind, it would paint of the same colour with those, which were reflected, and of the bigness of their intermediate spaces. And from hence the origin of these rings is manifest, namely, that the aerial interval of the glasses, according to its various thickness, is disposed in some places to reflect, and in others to transmit, the light of any colour; and, in the same place to reflect one colour, where it transmits another.

These observations so well pleased the Society, that they ordered Mr. OLDENBURG to desire Mr. NEWTON to permit them to be published, together with the rest; which, they presumed, did correspond with those, that had been now read to them.

Besides, there was read a passage of Mr. NEWTON's letter to Mr. OLDENBURG, of 21 December, 1675, stating the difference between his hypothesis and that of Mr. HOOKE. Which passage was as follows:

“ As for Mr. HOOKE's insinuation, that the sum of the hypothesis I sent you had been delivered by him in his Micrography, I need not be much concerned at the liberty he takes in that kind: yet, because you think it may do well, if I state the difference I take to be between them, I shall do it as briefly as I can, and that the rather, that I may avoid the favour of having done any thing unjustifiable or unhandsome towards Mr. HOOKE. But, for this end, I must first (to see what is his) cast out what he has borrowed from DES CARTES, or others, viz. that there is an æthereal medium; that light is the action of this medium; that this medium is less implicated in the parts of solid bodies, and so moves more freely in them, and transmits light more readily through them, and that after such a manner, as to accelerate the rays in a certain proportion; that refraction arises from this acceleration, and has fines proportional; that light is at first uniform; that its colours are some disturbance or new modification of its rays by refraction or reflection; that the colours of a prism are made by means of the quiescent medium, accelerating some motion of the rays on one side, where red appears, and retarding “ the

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"the other side, where blue appears; and, that there are but these two original colours, or colour-making modifications of light, which by their various degrees, or, as Mr. Hooke calls it, dilutions, produce all intermediate ones. This rejected, the remainder of his hypothesis is, that he has changed Des CARTES's pressing or progressive motion of the medium to a vibrating one, the rotation of the globuli to the obligation of pulses, and the accelerating their rotation on the one hand, and retarding it on the other, by the quiescent medium, to produce colours, to the like action of the medium on the two ends of his pulses for the same end. And having thus far modified his by the Cartesian hypothesis, he has extended it further, to explicate the phenomena of thin plates, and added another explication of the colours of natural bodies, fluid and solid.

"This, I think, is in short the sum of his hypothesis; and in all this I have nothing common with him, but the supposition, that æther is a susceptible medium of vibrations, of which supposition I make a very different use; he supposing it a light itself, which I suppose it is not. This is as great a difference as is between him and Des CARTES. But besides this, the manner of refraction and reflection, and the nature and production of colours in all cases (which takes up the body of my discourse) I explain very differently from him; and even in the colours of thin transparent substances, I explain every thing after a way so differing from him, that the experiments I ground my discourse on, destroy all he has said about them; and the two main experiments, without which the manner of the production of those colours is not to be found out, were not only unknown to him, when he wrote his Micrography, but even last spring, as I understood, in mentioning them to him. This therefore is the sum of what is common to us, that æther may vibrate; and so, if he thinks fit to use that notion of colours, arising from the various beats of pulses (without which his hypothesis will do nothing) he will borrow as much from my answer to his objections, as that I send you does from his Micrography.

"But, it may be, he means, that I have made use of his observations, and of some I did; as, that of the inflection of rays, for which I quoted him; that of opacity, arising from the interstices of the parts of bodies, which I insist not on; and that of plated bodies exhibiting colours, a phenomenon, for the notice of which I thank him. But he left me to find out and make such experiments to ground it, as might inform me of the manner of the production of those colours, to about an hypothesis on; he having given no further insight to it than this, that the colour depended on some certain thickness of the plate; though what that thickness was at every colour, he confesses in his Micrography, he had attempted in vain to learn; and therefore, seeing I was left to measure it myself, I suppose he will allow me to make use of what I took the pains to find out. And this I hope may vindicate me from what Mr. Hooke has been pleased to charge me with."

The reading of the rest of Mr. NEWTON's discourse was referred to the next meeting.

January

January 27. Mr. OLDENBURG produced from his highness prince RUPERT a piece of marble, having several pictures of boys and trees painted upon it in such a manner, that all the out-lines of the pictures were exactly defined without any flowing of the colours abroad, and the colours fixed by the fire, and afterwards so polished, that they would be permanent, and last as long as the marble.

This was acknowledged by the members to be a very great improvement of what had been done at Oxford by a certain stone-cutter there; and that all, that had been performed before in this art, was not comparable to this degree of improvement.

Mr. HOOKE remarked, that he conceived, that there were but two colours in this piece; and that he had a method of doing it with most colours, and to paint with them upon marble almost as curiously as with a pencil.

Mr. NEWTON's letter of January 25, 1678, in which he acknowledged the favour of the Society in their kind acceptance of his late papers; and declared, that he knew not how to deny any thing, which they desired should be done; but he requested, that the printing of his observations about colours might be suspended for a time, because he had some thoughts of writing such another set of observations for determining the manner of the production of colours by the prism: which observations, he said, ought to precede those now in the Society's possession, and would be most proper to be joined with them.

There was also read a letter of Mr. PASCALL of Somersetshire to Mr. AUBREY, dated 18 January, 1678, containing some natural observations of that county, viz. concerning the nature of the lead-mines in Mendip-Hills; a well resembling the sulphur-well near the Spaw in Yorkshire; a spring petrifying far more than the dropping-well at Knaresborough in the north; the motion of some underground waters in the parishes of ZOLANDE, formerly recovered from the sea, &c.

It was ordered, that the reading of Mr. NEWTON's observations about colours be continued at the next meeting.

February 3. There was presented from Dr. WALLIS his edition of ARCHIMEDES's *Arenarius*, with a new translation of his and notes, printed at Oxford, in 1676.

The reading of Mr. NEWTON's observations on colours was continued, viz. that part, wherein he explains by the simplest of colours the most recomounded; as follows:

"Obf. 16. The squares of the diameters of these rings, made by prismatic colour, were in arithmetical progression, as in the fifth observation. And the diameter of the sixth circle, when made by the yellow, and viewed almost perpendicularly, was about $\frac{11}{100}$ parts of an inch, agreeable to the sixth observation.

There are no letters entered from the beginning of the year 1678 till July 1677. perpen-

" The precedent observations were made with a rarer thin medium terminated by a denser, such as was air or water compressed between two glasses. In those, that follow, are set down the appearances of a denser medium thinned within a rarer; such as are plates of Mukovy-glass, bubbles of water, and some others thin substances terminated on all sides with air.

" Obs. 17. If a bubble be blown with water, first made tenacious by dissolving a little soap in it, it is a common observation, that after a while it will appear tinged with a great variety of colours. To defend these bubbles from being agitated by the external air (whereby their colours are irregularly moved one among another, so that no accurate observation can be made of them) as soon as I had blown any of them, I covered it with a clear glass, and by that means its colours emerged in a very regular order, like so many concentric rings encompassing the top of the bubble. And as the bubble grew thinner by the continual subsiding of the water, these rings dilated slowly, and overspread the whole bubble, descending in order to the bottom of it, where they vanished successively. In the mean while, after all the colours were emerged at the top, there grew in the center of the rings a small, round, black spot, like that in the first observation, which continually dilated itself, till it became sometimes more than one half or three fourths of an inch in breadth, before the bubble broke. At first I thought there had been no light reflected from the water in that place; but observing it more curiously, I saw within it several smaller, round spots, which appeared much blacker and darker than the rest, whereby I knew, that there was some reflection at the other places, which were not so dark as those spots. And by further trial I found, that I could see the images (as of a candle or the sun) very faintly reflected, not only from the great black spot, but also from the little darker spots, which were within it.

" Besides the aforesaid coloured rings, there would often appear small spots of colours ascending and descending up and down the side of the bubble, by reason of some inequalities in the subsiding of the water; and sometimes small black spots generated at the sides, would ascend up to the larger black spot at the top of the bubble, and unite with it.

" Obs. 18. Because the colours of these bubbles were more extended and lively than those of air thinned between two glasses, and so more easy to be distinguished, I shall here give you a further description of their order, as they were observed in viewing them by reflection of the skies, when of a white colour, whilst a black substance was placed behind the bubble: and of a white these; red, blue, red, blue; red, blue; red, green; red, yellow; green, blue, purple; red, yellow, green, blue, violet; red, yellow, white, blue, black.

" The three first successions of red and blue were very dilute and dirty, especially the first, where the red seemed in a manner to be white. Amongst these there was scarcely any other colour sensible, only the blues (and principally the second blue) inclined a little to green.

" The fourth red was also dilute and dirty, but not so much as the former three: after that succeeded little or no yellow, but a copious green, which at first was inclined a little to yellow, and then became a pretty brisk and good willow green, and afterwards changed to a bluish colour; but there succeeded neither blue nor violet.

" The fifth red at first was very much inclined to purple, and afterwards became more bright and brisk, but yet not very pure. This was succeeded with a very bright and intense yellow, which was but little in quantity, and soon changed to green; but that green was copious, and something more pure, deep, and lively, than the former green. After that followed an excellent blue of a bright sky colour; and then a purple, which was less in quantity than the blue, and much inclined to red.

" The sixth red was at first of a very fair and lively scarlet, and soon after of a brighter colour, being very pure and brisk, and the best of all the reds. Then, after a lively orange, followed an intense, bright, and copious yellow, which was also the best of all the yellows; and this changed, first to a greenish yellow, and then to a greenish blue; but the green between the yellow and blue was very little and dilute, seeming rather a greenish white than a green. The blue, which succeeded, became very good, and of a fair, bright, sky-colour; but yet something inferior to the former blue: and the violet was intense and deep, with little or no redness in it, and less in quantity than the blue.

" In the last red appeared a tincture of scarlet next the violet, which soon changed to a brighter colour, inclining to an orange: and the yellow, which followed, was at first pretty good and lively, but afterwards it grew more and more dilute, until by degrees it ended in perfect whiteness: and this whiteness, if the water was very tenacious and well tempered, would slowly spread and dilate itself over the greatest part of the bubble, continually growing paler at the top, where at length it would crack, and those cracks, as they dilated, would appear of a pretty good, but yet obscure and dark, sky-colour; the white between the blue spots diminishing, until it resembled the threads of an irregular net-work, and soon after vanished and left all the upper part of the bubble of the said dark blue colour; and this colour, after the aforesaid manner, dilated itself downwards, until sometimes it hath overpread the whole bubble. In the mean while, at the top, which was of a darker blue than the bottom, and appeared also of many round blue spots, something darker than the rest, there would emerge one or more very black spots, and within those, other spots of an intenser blackness, which I mentioned in the former observation; and those continually dilated themselves until the bubble broke.

" If the water was not very tenacious, the black spots would break forth in the white, without any sensible intervention of the blue: and sometimes they would break forth within the precedent yellow, or red, or perhaps within the blue of the second order, before the intermediate colours had time to display themselves.

" By

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" By this description you may perceive, how great an affinity these colours have with those of air, described in the fourth observation, although set down in a contrary order, by reason that they begin to appear, when the bubble is thickest, and are most conveniently reckoned from the lowest and thickest part of the bubble upwards.

" Obs. 19. Viewing, at several oblique positions of my eye, the rings of colours emerging on the top of the bubble, I found, that they were sensibly dilated by increasing the obliquity, but yet not so much by far, as those made by thinned air in the seventh observation. For there they distended so much, as, when viewed most obliquely, to arrive at a part of the place more than twelve lines thicker than that where they appeared, when viewed perpendicularly; whereas in this case the thickness of the water, at which they arrived when viewed most obliquely, was, to that thickness, which exhibited them by perpendicular rays, something less than eight to five. By the best of my observations, it was between fifteen and fifteen and a half to ten, an increase about twenty-four times less than in the other case.

" Sometimes the bubble would become of an uniform thickness all over, except at the top of it near the black spot, as I knew, because it would exhibit the same appearance of colours in all positions of the eye; and then the colours, which were seen at its apparent circumference by the obliquest rays, would be different from those, that were seen in other places by rays less oblique to it. And divers spectators might see the same part of it of differing colours, by viewing it at very differing obliquities. Now, observing how much the colours at the same place of the bubble, or at divers places of equal thickness, were varied by the several obliquities, by assistance of the fourth, fourteenth, sixteenth, and eighteenth observations, as they are hereafter explained, I collected the thickness of the water, requisite to exhibit any one the same colour at several obliquities, to be very nearly in the proportion expressed in this table.

Incidence on the water.		Refraction into the water.		Thickness of the water.
degr.	min.	degr.	min.	
00	00	00	00	10
15	00	11	11	10½
30	00	22	1	10¾
45	00	33	2	11½
60	00	47	30	13
75	00	46	25	14½
90	00	48	35	15½

" In the two first columns are expressed the obliquities of the rays to the superficies of the water; that is, their angles of incidence and refraction; where, I suppose, that the lines, which measure them, are in round numbers, as three to four, though probably the dissipation of soap in the water may a little alter its refractive virtue. In the third column the thickness of the bubble, O O 2

" at which any one colour is exhibited in those several obliquities, is express'd in parts, of which ten constitute that thickness, when the rays are perpendicular.

" I have sometimes observed of the colours, which arise on polished steel by heating it, or on bell-metal and some other metalline substances, when melted and poured on the ground, where it may cool in the open air, that they have, like those of water-bubbles, been a little changed by viewing them at divers obliquities; and particularly, that a deep blue or violet, when viewed very obliquely, hath been changed to a deep red. But the changes of these colours are not so sensible as of those made by water; for the scoria, or vitrified part of the metal, which most metals, when heated or melted, continually protrude to their surface, where, by covering them in form of a thin glassy skin, it causes these colours, is much denser than water, and I find, that the change made by the obliquation of the eye, is least in colours of the densest thin substances.

" Obs. 20. As in the ninth observation, so here, the bubble by transmitted light appeared of a contrary colour to that, which it exhibited by reflection. Thus, when the bubbles, being looked on by the light of the clouds reflected from it, seemed red at its apparent circumference, if the clouds at the same time, or very suddenly, were viewed through it, the colour at its circumference would be blue. And, on the contrary, when by reflected light it appeared blue, it would appear red by transmitted light.

" Obs. 21. By wetting plates of Muscovy-glass, whose thinness made the like colours appear, the colours became more faint, especially by wetting the plates on that side opposite the eye; but I could not perceive any variation of their species. So that the thickness of a plate requisite to produce any colour, depends only on the density of the plate, and not of the ambient medium. And hence, by the tenth and sixteenth observations, may be known the thickness of bubbles of water or plates of Muscovy-glass, or of any other substances, which they have at any colour produced by them.

" Obs. 22. A thin transparent body, which is denser than its ambient medium, exhibits more brisk and vivid colours than that, which is so much rarer, as I have particularly observed in air and glass; for, blowing glass very thin at a lamp furnace, those plates encompassed with air did exhibit colours much more vivid than those of air made thin between two glasses.

" Obs. 23. Comparing the quantity of light reflected from the several rings, I found it was most copious from the first or inmost, and in the exterior rings became gradually less and less. Also the whiteness of the first ring was stronger than that reflected from those parts of the thinned medium, which were without the rings, as I could manifestly perceive by viewing at distance the rings made by the two object glasses; or by comparing two bubbles of water blown at distant times, in the first of which the whiteness appeared, which succeeded the colours, and the whiteness, which preceded them, in the other.

" Obs.

" Obf. 24. When the two object-glasses were laid upon one another, so as to make the rings of colours appear, though with my naked eye I could not discern above eight or nine of those rings, yet, by viewing them through a prism, I have seen a far greater multitude, inasmuch, that I could number more than forty, besides many others, that were so very small and close together, that I could not keep my eye so steady on them severally as to number them : but by their extent I have sometimes estimated them to be more than a hundred. And, I believe, the experiment may be improved to the discovery of far greater numbers ; for they seem to be really unlimited, though visible only so far as they can be separated by the refraction, as I shall hereafter explain.

" But it was but one side of these rings, namely, that, towards which the refraction was made, which by that refraction was rendered distinct ; and the other side became more confused than to the naked eye, inasmuch that there I could not discern above one or two, and sometimes none of those rings, of which I could discern eight or nine with my naked eye. And their segments, or arcs, which on the other side appeared so numerous, for the most part extended not the third part of a circle. If the refraction was very great, or the prisms very distant from the object-glasses, the middle part of those arcs became also confused, so as to disappear and constitute an even whiteness, whilst on either side their ends, as also the whole arcs farthest from the center, became distincter than before, appearing in the form you see them here designed.

Fig. II.



" The arcs, where they seemed distinctest, were only white and black successively, without any other colours intermixed. But in other places there appeared colours whose order was inverted by the refraction, in such manner, that, if I first held the prism very near the object-glasses, and then gradually removed it farther off towards my eye, the colours of the second, third, fourth, and following rings shrank towards the white, that emerged between them, until they wholly vanished into it at the middle of the arcs, and afterwards emerged again in a contrary order : but at the end of the arcs they retained their order unchanged.

" I have sometimes so laid one object-glass upon the other, that, to the naked eye, they have all over seemed uniformly white, without the least appearance of any of the coloured rings ; and yet, by viewing them through a prism, great multitudes of those rings have discovered themselves. And, in like manner, plates of Muscovy glass, and bubbles of glass blown at a lamp furnace, which were not so thin, as to exhibit any colours to the naked eye, have through the prism exhibited a great variety of them, ranged irregularly up and down, in the form of waves. And so bubbles of water, before they began to exhibit their colours to the naked eye of a by-stander, have appeared, through a prism, girded about with many parallel and horizontal rings ; to produce whichever, it was necessary to hold the prism parallel, or very nearly parallel, to the horizon, and to dispose it so, that the rays might be refracted upwards.

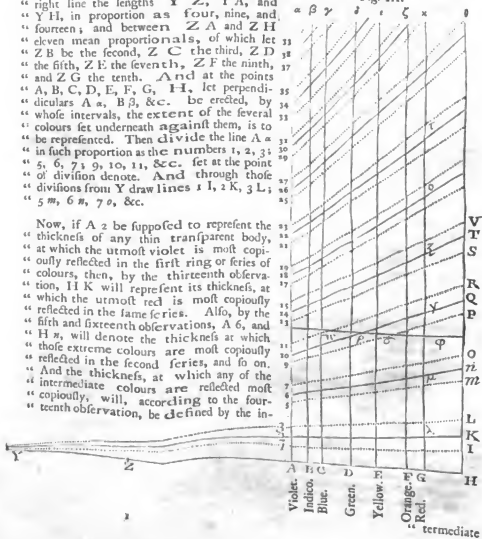
" Having

" Having given my observations of these colours, before I make use of them
 " to unfold the causes of the colours of natural bodies, it is convenient, that, by
 " the simplest of them, I first explain the more compounded; such as are the
 " second, third, fourth, ninth, twelfth, eighteenth, twentieth, and twenty-fourth.

" And first, to show how the colours in the fourth and eighteenth observations
 " are produced, let there be taken in any
 " right line the lengths $Y Z$, $Y A$, and
 " $Y H$, in proportion as four, nine, and
 " fourteen; and between $Z A$ and $Z H$
 " eleven mean proportionals, of which let
 " $Z B$ be the second, $Z C$ the third, $Z D$
 " the fifth, $Z E$ the seventh, $Z F$ the ninth,
 " and $Z G$ the tenth. And at the points
 " A, B, C, D, E, F, G, H , let perpendi-
 " culars $A a, B \beta, \&c.$ be erected, by
 " whose intervals, the extent of the several
 " colours set underneath against them, is to
 " be represented. Then divide the line $A a$
 " in such proportion as the numbers 1, 2, 3;
 " 5, 6, 7; 9, 10, 11, &c. set at the point
 " of division denote. And through those
 " divisions from Y draw lines $1, 2, K, 3, L$;
 " $5 m, 6 n, 7 o, \&c.$

Now, if $A a$ be supposed to represent the
 thickness of any thin transparent body,
 at which the utmost violet is most cop-
 iously reflected in the first ring or series of
 colours, then, by the thirteenth observa-
 tion, $H K$ will represent its thickness, at
 which the utmost red is most copiously
 reflected in the same series. Also, by the
 fifth and sixteenth observations, $A a$ and
 $H n$, will denote the thickness at which
 those extreme colours are most copiously
 reflected in the second series, and so on.
 And the thickness, at which any of the
 intermediate colours are reflected most
 copiously, will, according to the four-
 teenth observation, be defined by the in-

Fig. III.



“ intermediate parts of the lines 2 K, 6 N, &c. against which the names of those colours are written below.

“ But farther, to define the latitude of these colours in each ring or series, let A 1 design the least thickness, and A 3 the greatest thickness, at which the extreme violet in the first series is reflected; and let H 1 and H L design the like limit for the extreme red, and the intermediate colours be limited by the intermediate parts of the lines, 1 I and 3 L; against which the names of those colours are written. And in the second series, let those limits be the lines 5 M and 7 O; and so on: but yet with this caution, that the reflections be supposed strongest at the intermediate spaces, 2 K, 6 N, 10 R, &c. and to decrease gradually towards these limits, 1 I, 3 L; 5 M, 7 O, &c. on either side, where you must not conceive them to be precisely limited, but to decay indefinitely. And whereas I have designed the same latitude to every series, I did it, because, although the colours in the first series seem to be a little broader than the rest, by reason of a stronger reflection there; yet that inequality is so insensible as scarcely to be determined by observation.

“ Now, according to this description, conceiving, that the rays, in which several colours in here, are by turns reflected at the space 1 K, 3 L, 5 M, O 7, 9 P, R 11, &c. and transmitted at the spaces A H I 1, 3 L, M 5, 7 O, P 9, &c. it is easy to know what colour in the open air must be exhibited at any thickness of a transparent thin body. For, if a ruler be applied parallel to A H, at that distance from it by which the thickness of the body is represented, the alternate spaces 1 I, L 3, 5 M, O 7, &c. which it crosseth, will denote the reflected original colours, of which the colour exhibited in the open air is compounded. Thus, if the constitution of the green in the third series of colours be desired, apply the ruler, as you see, at π ρ ρ , and by its passing through some of the blue at π , and yellow at ρ , as well as through the green ρ , you may conclude, that green, exhibited at that thickness of the body, is principally constituted of original green, but not without a mixture of some blue and yellow. By this means you may know, how the colours from the center of the rings outwards ought to succeed in order, as they were described in the fourth and eighteenth observations: for, if you move the ruler gradually from A H through all distances, having past over the first space, which denotes little or no reflection to be made by thinnest substances, it will first arrive at 1, the violet, and then very quickly at the blue and green, which together with that violet compounded blue, and then at the yellow and red, by whose further addition, that blue is converted into whiteness, which whiteness continues during the transit from I to 3; and after that, by the successive deficiency of its component colours, turns first to compound yellow, and then to red, and last of all the red ceaseth at L. Then begin the colours of the second series, which succeed in order between 5 and O, and are more lively than before, because more expanded and severed. And, for the same reason, instead of the former white, there intercedes between the blue and yellow a mixture of orange, yellow, green, blue and indico, all which together ought to exhibit a dilute an imperfect green. So the colours of the third series all succeed in order

order; first the violet, which a little interferes with the red of the second order, and is thereby inclined to a redish purple; then the blue and green, which are less mixed with other colours, and consequently more lively than before, especially the green. Then follows the yellow, some of which towards the green is distinct and good; but that part of it towards the succeeding red, as also that red, is mixed with the violet and blue of the fourth series, whereby various degrees of red, very much inclining to purple, are compounded. The violet and blue, which should succeed this red, being mixed with, and hidden in it, there succeeds a green; and this at first is much inclined to blue, but soon becomes a good green; the only unmixed and lively colour in this fourth series: for as it verges towards the yellow, it begins to interfere with the colours of the fifth series, by whose mixture the succeeding yellow and red are very much diluted, and made dirty, especially the yellow, which being the weaker colour, is scarce able to shew itself. After this the several series interfere more and more, and their colours become more and more intermixed, till after three or four revolutions (in which the red and blue predominate by turns) all sorts of colours are in all places pretty equally blended, and compound one even whiteness.

And since, by the fifteenth observation, the rays indued with one colour are transmitted, where those of another colour are reflected, the reason of the colours made by the transmitted light, in the ninth and twentieth observations, is also from hence evident.

If not only the order and species of these colours, but also the precise thickness of the plate, or thin body, at which they are exhibited, be desired in parts of an inch, that may be also performed by assistance of the sixth or sixteenth observation. For, according to those observations, the thickness of the thinned air, which, between two glasses, exhibited the orange or bright red of the sixth order, was $\frac{1}{12}$ parts of an inch. Now, suppose this thickness be represented by G τ , and the eleventh part of it, G λ , will be about $\frac{1}{132}$ of an inch. And so G μ , G V, G L, G o, will be $\frac{1}{165}$, $\frac{1}{198}$, $\frac{1}{220}$, $\frac{1}{286}$ of an inch. And this being known, it is easy to determine what thickness of air is represented by G e, or any other distance of the ruler from A H.

But further, since, by the tenth observation, the thickness of air was to the thickness of water, which between the same glasses exhibited the same colour, as four to three; and, by the twenty-first observation, the colours of thin bodies are not varied by varying the ambient medium; the thickness of a bubble of water exhibiting any colour will be three fourths of the thickness of air producing the same colour. And so, according to the same tenth and twenty-first observations, the thickness of a plate of glass, whose refraction is measured by the proportion of the sines thirty-one to twenty, may be $\frac{2}{3}$ of the thickness of air producing the same colours: and the like of other mediums. On these grounds I have composed the following table; wherein the thickness of air, water, and glass, at which each colour is most intense and specific, is expressed in parts of an inch divided into ten hundred thousand equal parts.

“ The

The thickness of

	Air	Water	Glass
The colours of the first order	Black	2	1 $\frac{1}{2}$ or less.
	Blue	2 $\frac{1}{2}$	1 $\frac{1}{2}$
	White	4	3 $\frac{1}{2}$
	Yellow	5 $\frac{1}{2}$	5 $\frac{1}{2}$
	Orange	9	6 $\frac{1}{2}$
	Red	10	7 $\frac{1}{2}$
Of the second order	Violet	12	9 $\frac{1}{2}$
	Indico	13 $\frac{1}{2}$	11
	Blue	14 $\frac{1}{2}$	12
	Green	16	13 $\frac{1}{2}$
	Yellow	17 $\frac{1}{2}$	14 $\frac{1}{2}$
	Orange	19 $\frac{1}{2}$	15 $\frac{1}{2}$
	Bright red	20	16
	Scarlet	21 $\frac{1}{2}$	17 $\frac{1}{2}$
Of the third order	Purple	23	17 $\frac{1}{2}$
	Indico	24	18
	Blue	25 $\frac{1}{2}$	19
	Green	27 $\frac{1}{2}$	20 $\frac{1}{2}$
	Yellow	29 $\frac{1}{2}$	22
	Red	31	23 $\frac{1}{2}$
	Bluish red	33 $\frac{1}{2}$	25
Fourth order	Bluish	36	27
	Green	37 $\frac{1}{2}$	28 $\frac{1}{2}$
	Yellowish green	39 $\frac{1}{2}$	29 $\frac{1}{2}$
	Red	44	33
Fifth order	Greenish blue	50 $\frac{1}{2}$	38
	Red	57 $\frac{1}{2}$	43
Sixth order	Greenish blue	64	48
	Red	70 $\frac{1}{2}$	53
Seventh order	Greenish blue	77 $\frac{1}{2}$	58
	Red or White	84	63

" Now, if this table be compared with the third scheme, you will there see the constitution of each colour, as to its ingredients, or the original colours, of which it is compounded, and thence be enabled to judge of its intenseness or imperfection, which may be in explanation of the fourth and eighteenth Vol. III.

“ observations, unless it be further desired to delineate the manner, how the colours appear, when the two object-glasses are laid upon one another: to do which let there be described a large arc of a circle and a strait line, which may touch that arc; and parallel to that tangent several occult lines at such distances from it, as the numbers set against the several colours in the table denote. For the arc and its tangent will represent the superficies of the glasses, terminating the interjacent air, and the places, where the occult lines cut the arc, will show at what distances from the center, or point of the contact, each colour is reflected.

“ There are also other uses for this table; for by its assistance the thickness of the bubble, in the nineteenth observation, was determined by the colours, which it exhibited. And so the bigness of the parts of natural bodies may be conjectured at by their colours, as shall be hereafter shown. Also, if two or more very thin plates be laid one upon another, so as to compose one plate, equalling them all in thickness, the resulting colour may be hereby determined. For instance, Mr. Hooke, in his *Micrographia*, observes, that a faint yellow plate of Muscovy glass, laid upon a blue one, constituted a very deep purple. The yellow of the first order is a faint one, and the thickness of the plate exhibiting it, according to the table, is $5\frac{1}{2}$, to which add $9\frac{1}{2}$, the thickness exhibiting blue of the second order, and the sum will be $14\frac{1}{2}$, which most nearly approaches $14\frac{1}{2}$, the thickness exhibiting the purple of the third order.

“ To explain, in the next place, the circumstances of the second and third observations, that is, how the colours (by turning the prisms about their common axis the contrary way to that expressed in those observations) may be converted into white and black rings, and afterwards into colours again in an inverted order; it must be remembered, that those colours are dilated by obliquation of rays to the air, which intercedes the glasses; and that, according to the table in the seventh observation, their dilatation or reflection from the common center is most manifest and speedy when they are oblique. Now, the rays of yellow being more refracted by the first superficies of the said air than those of red, are thereby made more oblique to the second superficies, at which they are reflected, to produce the coloured rings; and consequently, the yellow in each ring will be more dilated than the red; and the excess of its dilatation will be so much the greater, by how much the greater is the obliquity of the rays, until at last it become of equal extent with the red of the same ring. And, for the same reason, the green, blue, and violet, will be also so much dilated by the still greater obliquity of their rays, as to become all very nearly of equal extent with the red; that is, equally distant from the center of the rings. And then all the colours of the same series must be coincident, and by their mixture exhibit a white ring; and these white rings must have black or dark rings between them, because they do not spread and interfere with one another as before; and, for that reason also, they must become distinct, and visible to far greater numbers. But yet the violet, being obliquest,

- “ obliqueſt, will be ſomething more dilated in proportion than the other colours;
 “ and fo very apt to appear at the exterior verges of the white.

“ Afterwards, by a greater obliquity of the rays, the violet and the blue become ſenſibly more dilated than the red and yellow; and ſo being further removed from the center of the rings, the colours muſt emerge out of the white in an order contrary to that which they had before, the violet and blue at the exterior limbs, and the red and yellow at the interior. And the violet, by reaſon of the greateſt obliquity of its rays, being, in proportion, moſt of all expanded, will ſoonest appear at the exterior limb of each white ring, and become more conſpicuous than the reſt. And the ſeveral ſeries of colours, by their unfolding and ſpreading, will begin again to interie, and thereby render the rings leſs diſtinct, and not viſible to ſo great numbers.

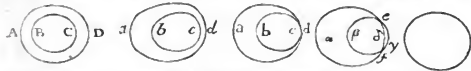
“ If, inſtead of the priſms, the object-glaſſes be made uſe of, the rings, which they exhibit, become not white and diſtinct by the obliquity of the eye, by reaſon, that the rays, in their paſſage through that air, which interceded the glaſſes, are very nearly parallel to themſelves, when firſt incident on the glaſſes; and conſequently, thoſe indued with ſeveral colours are not inclined one more than another to that air, as it happens in the priſms.

“ There is yet another circumſtance of theſe experiments to be conſidered; and that is, why the black and white rings, which, when viewed at a diſtance, appear diſtinct, ſhould not only become conſuſed by viewing them near at hand, but alſo yield a violet colour at both the edges of every white ring: and the reaſon is, that the rays, which enter the eye at ſeveral parts of the pupil, have ſeveral obliquities to the glaſſes, and thoſe, which are moſt oblique, if conſidered apart, would represent the rings bigger than thoſe, which are leaſt oblique. Whence the breadth of the perimeter of every white ring is expanded outwards by the obliqueſt rays, and inwards by the leaſt oblique. And this expansion is ſo much the greater, by how much the greater is the difference of the obliquity; that is, by how much the pupil is wider, or the eye nearer to the glaſſes: and the breadth of the violet muſt be moſt expanded, becauſe the rays, apt to excite a ſenſation of that colour, are moſt oblique to the ſecond or further ſuperficies of the thinned air, at which they are reflected; and have alſo the greateſt variation of obliquity, which makes that colour ſoonest emerge out of the edges of the white. And, as the breadth of every ring is thus augmented, the dark intervals muſt be diminiſhed, until the neighbouring rings become continuous, and are blended, the exterior firſt, and then thoſe nearer the center; ſo that they can no longer be diſtinguiſhed apart, but ſeem to conſtitute an even and uniform whiteness.

“ Amongſt all the obſervations there is none accompanied with ſo odd circumſtances as the twenty-fourth. Of thoſe the principal arc, that in thin plates, which, to the naked eye, ſeem of an even and uniform transparent whiteness, the refraction of a priſm ſhould make the rings of colours appear; whereas it uſually makes objects to appear coloured only, where they are terminated with ſhadows,

" shadows, or have parts unequally luminous; and that it should make those
 " rings exceedingly distinct and white, although it usually renders those objects
 " confused and coloured. The cause of these things you will understand by
 " considering, that all the rings of colours are really in the plate, when viewed
 " by the naked eye, although, by reason of the great breadth of their circum-
 " ferences, they so much interfere, and are blended together, that they seem to
 " constitute an even whiteness. But, when the rays pass through the prism to
 " the eye, the orbits of the several colours in every ring are refracted, some more
 " than others, according to their degree of refrangibility; by which means the
 " colours on one side of the ring become more unfolded and dilated, and on the
 " other side more complicated and contracted. And where, by a due refraction,
 " they are so much contracted, that the several rings become narrower
 " than to interfere with one another, they must appear distinct, and also white,
 " if the constituent colours be so much contracted as to be wholly coinci-
 " dent: but on the other side, where every ring is made broader by the further
 " unfolding its colours, it must interfere more with other rings than before, and
 " so become less distinct.

" To explain this a little further; suppose the concentric circles, A B and
 " C D, represent the red and violet of any order, which, together with the in-
 " termediate colours, constitute any one of these rings. Now, these being
 " viewed through a prism, the violet circle, B C, will, by a greater refraction, be
 " further translated from its place than the red, A D, and so approach nearer



" to it on that side towards which the refractions are made. For instance, if
 " the red be translated to a d, the violet may be translated to b c, so as to ap-
 " proach nearer to it at c than before; and, if the red be further translated to
 " a d, the violet may be so much further translated to b c, as to convene with
 " it at c, and, if the red be yet further translated to a d, the violet may be still
 " so much further translated to b c, as to pass beyond it at c, and convene with it
 " at e and f. And this being understood, not only of the red and violet, but of
 " all the other intermediate colours; and also of every revolution of those col-
 " ours, you will easily perceive, how these of the same revolution or order, by
 " their narrowness at c d, and their coincidence at c d, e and f, ought
 " to constitute pretty distinct arcs of circles, especially at c d, or at e and f, and
 " that they will appear several at c d, at c d exhibit whiteness by their coinci-
 " dence, and again appear several at e f, but yet in a contrary order to that
 " which they had before, these colours must become much more confused by
 " being dilated, and spread so as to interfere with those of other orders. And
 " the same confusion will happen at e f between e and f, if the refraction be
 " very

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“ very great, or the prism very distant from the object-glasses; in which case no
“ parts of the ring will be seen, save only two little arcs at e and f , whose distance
“ from one another will be augmented by removing the prism still further from
“ the object-glasses. And these little arcs must be distinct and whitest at their
“ middle; and at their ends, where they grow confused, they must be coloured;
“ and the colours at one end of every arc must be in a contrary order to those
“ at the other end, by reason that they cross in the intermediate white; namely,
“ their ends, which verge towards $\delta \gamma$, will be red, and yellow on that side next
“ the center, and blue and violet on the other side. But their other ends, which
“ verge from $\delta \gamma$, will, on the contrary, be blue and violet on that side towards
“ the center, and on the other side red and yellow.

“ For confirmation of all this, I need alledge no more, than that it is mathe-
“ matically demonstrable from my former principles. But I shall add, that they,
“ which please to take the pains, may by the testimony of their senses be assured,
“ that these explications are not hypothetical, but infallibly true and genuine:
“ for in a dark room, by viewing these rings through a prism, by reflection of
“ the several prismatic colours, which an assistant causes to move to and fro
“ upon a wall or paper, from whence they are reflected, whilst the spectator is
“ eye, the prism, and object-glasses (as in the thirteenth observation) are placed
“ steadily, the position of the circles, made successively by the several colours,
“ will be found such, in respect of one another, as I have described at $a b c d$, or
“ $a b c d$, or $a \beta \gamma \delta$. And by the same method the truth of the explications of
“ the other observations is to be examined.

“ By what hath been said, the like phenomena of water-bubbles and thin
“ plates of glass may be understood. But in small fragments of those plates,
“ there is this further observable, that, if they, lying flat upon a table, be turned
“ about their center, whilst they are viewed through a prism, some of them ex-
“ hibit waves in one or two positions only; but the most of them do in all posi-
“ tions exhibit those waves, and that for the most part appearing almost all over
“ the glass. The reason is, that the superficies of such plates are not even; but
“ have many cavities and swellings, which, how shallow soever, do a little vary
“ the thickness of the plate; and by the several sides of those cavities there
“ must be produced waves in several postures of the prism. Now, though it
“ be but some very small and narrow parts of the glass, by which these waves
“ for the most part are caused, yet they may seem to extend themselves over the
“ whole glass, because from the narrowest of those parts there are colours of several
“ orders confusedly reflected, which by refraction of the prism are unfolded, and
“ dispersed to several places, so as to constitute so many several waves as there
“ were divers orders of the colours promiscuously reflected from that part of the
“ glass.

“ These are the principal phenomena of thin plates or bubbles, whose expli-
“ cations depend on the properties of light, that I have heretofore delivered:
“ and these, you see, do necessarily follow from them, and agree with them: even
“ to their very least circumstances; and not only so, but do very much tend to
“ their

" their proof. Thus, by the twenty-fourth observation, it appears, that the rays of several colours, made, as well by thin plates or bubbles, as by the refractions of a prism, have several degrees of refrangibility, whereby those of each order, which, at their reflection from the plate or bubble, are intermixed with those of other orders, are separated from them by refraction, and associated together, so as to become visible by themselves, like arcs of circles. For, if the rays were all alike refrangible, it is impossible, that the whiteness, which to the naked sense appears uniform, should by refraction have its parts transposed, and ranged into those black and white arcs.

" It appears also, that the unequal refractions of dissimilar rays proceed not from any contingent irregularities, such as are veins, an uneven polish, or fortuitous position of the pores of glass, unequal motions in the air or æther, spreading, breaking, or dividing the same ray into many diverging parts, or the like. For, admitting any such irregularities, it would be impossible for refractions to render those rings so very distinct and well defined, as they do in the twenty-fourth observation. It is necessary therefore, that every ray have its proper and constant degree of refrangibility connate with it; according to which its refraction is ever justly and regularly performed, and that several rays have several of those degrees.

" And what is said of their refrangibility may be understood of their reflexivity; that is, of their dispositions to be reflected, some at a greater, and others at a less thickness of thin plates or bubbles, namely, that those dispositions are also connate with the rays, and immutable, as may appear by the thirteenth, fourteenth, and fifteenth observations, compared with the fourth and eighteenth.

" By the precedent observations it appears also, that whiteness is a dissimilar mixture of all colours, and that light is a mixture of rays endowed with all those colours. For, considering the multitude of the rings of colours in the third, twelfth, and twenty-fourth observations, it is manifest, that, although in the fourth and eighteenth observations there appear more than eight or nine of those rings, yet there are really a far greater number, which so much interfere and mingle with one another, as, after those eight or nine revolutions, to dilute one another wholly, and constitute an even and sensible uniform whiteness. And consequently, that whiteness must be allowed a mixture of all colours, and the light, which conveys it to the eye, must be a mixture of rays endowed with all those colours.

" But further, by the twenty-fourth observation it appears, that there is a constant relation between colours and refrangibility, the most refrangible rays being violet, the least refrangible red, and those of intermediate colours having proportionally intermediate degrees of refrangibility. And, by the thirteenth, fourteenth, and fifteenth observations, compared with the fourth or eighteenth, there appears to be the same constant relation between colour and refrangibility; the violet being on equal terms reflected at least thickness of any thin plate

- .. plate or bubble; the red at greatest thickness, and the intermediate colours at intermediate thicknesses: whence it follows, that the colorific dispositions of
- .. rays are also connate with them, and immutable; and by consequence, that all
- .. the productions and appearances of colours in the world are derived, not from
- .. any physical change caused in light by refraction or reflection, but only from
- .. the various mixtures or separations of rays, by virtue of their different refrangibility or reflexibility. And, in this respect it is, that the science of colours
- .. becomes a speculation more proper for mathematicians than naturalists.

This being read, occasion was taken to discourse of Mr. Newton's theory itself, and to debate, whether the rays of light, which, though alike incident in the same medium, yet exhibit different colours, may not reasonably be said to owe that exhibition of different colours to the several degrees of the velocity of pulses, rather than, as Mr. Newton thought, to the several connate degrees of reirangibility in the rays themselves?

Mr. HOOKE was of opinion, that the former of these ways was sufficient to give a good account of the diversity of colours.

February 10. Dr. MAPLETOFT was elected and admitted.

Capt. SHEERES, Mr. HALL, and Signor TRAVAGINO were elected.

Mr. BERCHENSHAW presented himself to the Society, and shewed them his scale of music, wherein were contained,

1. A table of all consonant and dissonant intervals suitable to musical harmony, which are practicable, and may be expressed by the voice and other instruments. To these respective intervals apt and proper numbers were assigned, by which their ratios and proportions were demonstrated.
2. A system of all the keys, by which the aforesaid intervals were completed; of which keys some were natural; some intended to the first degree of acuteness; some remitted to the first degree of gravity; some twice flatted; some twice asperated.
3. In this scale the magnitude, dimension, and proportion of the said keys were exactly demonstrated according to the proportional parts of a chord, the chord being supposed thirty-six inches long.

If it were demanded, whether there was any thing in this table and system, that was not to be found in the scales and writings of other musicians? he answered,

1. That the intervals in this table were perfect and complete. There was not one too many, nor one wanting, which might conduce to the making of harmony.
2. That

2. That the founds or musical numbers contained in this system arose out of the unison, and from one another, according to the reason of figurate, not simple numbers, (as, he said, he could demonstrate by numbers assigned to the respective intervals in the table) for that so the reason of the state of music required.

3. That there are neither more or less keys in this system, than would complete the aforesaid intervals.

4. That in this scale all the tones are of the same ratio, and that so are all the semitones, semiditones, ditones, and other intervals.

5. That the true magnitude and dimension of every one of the said keys are demonstrated according to the proportional parts of a chord.

6. That the natural, genuine, and true reason of the excellency and fullness of the harmony of three, four, five, six, and seven parts, may clearly be discerned by the system of seven parts.

He added, that many other things were to be found in this table and scale, of which little or no mention is made in the scales and writings of either modern or ancient musical authors; which, he said, he intended to discover, and to write of them at large, as he should be enabled thereunto.

He was exhorted to finish this work, or at least to publish this system with an explanation thereof.

After this was read the last part of Mr. NEWTON's *observations*, wherein he considered in nine propositions, how the phenomena of thin transparent plates stand related to those of all other natural bodies: of which bodies having before mentioned, that they appear of divers colours, according as they are disposed to reflect most copiously the rays indued with these colours, he now inquires after their constitutions.

Here, among many other considerable things, he shews, how the bigness of the component parts of natural bodies may be conjectured by their colours: as also, that the cause of reflexion is not the impinging of light on the solid and impervious parts of bodies, as was commonly supposed.

This last part was as follows:

"I am now come to the last part of this design; which is, to consider, how the phenomena of thin transparent plates stand related to those of all other natural bodies. Of these bodies I have already told you, that they appear of divers colours, according as they are disposed to reflect most copiously the rays indued with those colours. But their constitutions, whereby they reflect some rays
2
"more

more copiously than others, remains to be inquired after. And this I shall endeavour in the following propositions.

Prop. 1. Those superficies reflect the greatest quantity of light, which have the greatest refracting power; that is, which interceeds mediums, that differ most in their refracting densities; and in the confines of equally dense mediums there is no reflection.

The analogy between reflection and refraction will appear by considering, that when light passeth obliquely out of one medium into another, which refracts from the perpendicular, the greater is the difference of their density, the less obliquity is requisite to cause a total reflection; because as the sines are, which measure the refraction, so is the sine of incidence, at which the total reflection begins, to the radius of the circle; and consequently that incidence is least, where there is the great difference of the sines. Thus in the passing of light out of water into air, where the refraction is measured by the ratio of the sines, 3 to 4, the total reflection begins, when the angle of the incidence is about forty-eight degrees and thirty-five minutes. In passing out of glass into air, where the refraction is measured by the ratio of the sines 20 to 31, the total reflection begins, when the angle of incidence is forty degrees and ten minutes; and so, in passing out of crystal, or more strongly refracting mediums, into air, there is still a less obliquity requisite to cause a total reflection. Superficies therefore, which refract most, do soonest reflect all the light, which is incident on them, and so must be allowed most strongly reflective.

But the truth of this proposition will further appear, by observing, that in the superficies, interceeding any two of those mediums, air or water, or other liquors, common glass, crystal, and metalline glasses, the reflection is stronger, or weaker accordingly as the superficies hath a greater or less refracting power. Thus, when other mediums are contiguous to air, the reflection is stronger in the superficies of glass than of water, still stronger in the superficies of crystal, and strongest in the superficies of metalline glass. So, in the confine of water and common glass, the reflection is very weak, but yet stronger than in the confine of water and oil, or almost any other two liquors, and still stronger in the confine of water and crystal, or metalline glass: accordingly as those mediums differ more or less in density, so in the confine of common glass and crystal there is a weak reflection, and a stronger reflection in the confine of common and metalline glass: but in the confine of two glasses of equal density, there is not any sensible reflection, as was shewn in the first observation. And the same may be understood of the superficies of two crystals or liquors, or any other substances, in which no refraction is caused: whence it comes to pass, that uniform mediums have no sensible reflexion but in their external superficies, where they are adjacent to their mediums of a different density.

Prop. 2. The least parts of natural bodies are in some measure transparent; and the opacities of those bodies arise from the multitude of reflections caused in their internal parts.

That

" That this is so, will easily be granted by them, that have been conversant with
 " microscopes : and it may be also tried by applying any substance to a hole, through
 " which the light is emitted into a dark room ; for how opaque soever that sub-
 " stance may seem in the open air, it will, by that means, appear very manifestly
 " transparent, if it be of a sufficient thickness : only metalline bodies must be ex-
 " empted, which, by reason of their excessive density seem to reflect almost all the
 " light incident on their first superficies.

" Prop. 3. Between the parts of opaque or coloured bodies are many interstices,
 " replenished with mediums of other densities, as water between the tinging cor-
 " puscules, wherewith any liquor is impregnated ; air between the aqueous globules
 " that constitute clouds or mists ; and for the most part spaces void of both air
 " and water ; but yet perhaps replenished with some subtiler medium between
 " the parts of hard bodies.

" The truth of this is evinced by the two precedent propositions : for by the
 " second proposition there are many reflections from the internal part of bodies,
 " which by the first proposition would not happen, if the parts of those bodies
 " were continued without any such interstices between them, because reflections
 " are caused only in superficies, which interceed mediums of a different density.

" But further, that this discontinuity of parts is the principal cause of the opa-
 " city of bodies, will appear by considering, that opaque substances become trans-
 " parent by filling their pores with any substance of equal, or almost equal density
 " with their parts. Thus paper dipped in water or oil, the oculus mundi stone
 " steeped in water, linen-cloth oiled or varnished, and many other substances soaked
 " in such liquors, as will intimately pervade their little pores, become by that
 " means more transparent than otherwise. So, on the contrary, the most trans-
 " parent substances may, by separating their parts, be rendered sufficiently opaque ;
 " as glass, by being reduced to powder, or otherwise flawed, water by being form-
 " ed into many small bubbles, either alone in the form of froth, or by shaking
 " it together with oil of turpentine, or some other convenient liquor, with which
 " it will not incorporate, and horn by being scraped.

" To the increase of the opacity of these bodies it conduces something, that by
 " the twenty third observation, the reflections of very thin transparent substances
 " are considerably stronger than those made by the same substances of a greater
 " thickness. And to the reflection of solid bodies it may be further added, that
 " the interstices of their parts are void of air. For that for the most part they
 " are so, is reasonable to believe, considering the ineptitude, which air hath to
 " pervade small cavities, as appears by the ascension of water in slender glass
 " pipes, paper, cloth, and other such like substances, whose pores are found to
 " small to be replenished with air, and yet large enough to admit water ; and b
 " the difficulty, wherewith air pervades the pores of a bladder, through whic
 " water find ready passage. And according to the eleventh observation, the c
 " vities thus void of air will cause the same kind of effects as to reflection, whi
 " those do, that are replenished with it ; but yet something more manifestly, t
 " ca

“ cause the medium in relation to refractions is rarest, when most empty of air
 “ as Mr. Hooke hath proved in his Micrographia; in which book he hath also
 “ largely discoursed of this and the precedent proposition, and delivered many
 “ other very excellent things concerning the colours of thin plates, and other natural
 “ bodies, which I have not scrupled to make use of so far as they were for
 “ my purpose.

“ Prop. 4. The parts of bodies and their interstices must not be less than
 “ of some definitive bigness, to render them opaque and coloured; for the opaquest
 “ bodies, if their parts be subtilly divided (as metals by being dissolved in acid
 “ menstruums, &c.) become perfectly transparent. And you may also remem-
 “ ber, that in the eighth observation there was no reflection at the superficies of
 “ the object-glasses, where they were very near one another, though they did not
 “ absolutely touch. And in the seventeenth observation, the reflection of the
 “ water-bubble, where it became thinnest, was almost insensible, so as to cause the
 “ apparitions of very black spots.

“ On these grounds I conceive it is, that water, salt, glass, stones, and such
 “ like substances, are transparent; for, upon divers considerations, they seem to
 “ be as porous as other bodies; but yet their pores and parts too small to cause
 “ any opacity.

“ Prop. 5. The transparent parts of bodies, according to their several sizes,
 “ must reflect rays of one colour, and transmit those of another, on the same
 “ grounds, that thin plates or bubbles do reflect or transmit those rays: and this
 “ I take to be the ground of all their colours.

“ For, if a thinned or plated body, which being of an even thickness appears
 “ all over of one uniform colour, should be broken into fragments of the same
 “ thickness with the plate, I see no reason, why a heap of those fragments should
 “ not constitute a powder of the same colour, which the plate exhibited before it
 “ was broken. And the parts of all natural bodies, being like so many fragments
 “ of a plate, must on the same grounds exhibit the same colours.

“ Now, that they do so, will further appear by the affinity of their proper-
 “ ties: as that the infusion of nephritic-wood, and many other substances reflect
 “ one colour, and transmit another, like thin bodies in the ninth and twentieth
 “ observations. That the colour of silks, cloaths, and others substances, which
 “ water or oil can intimately penetrate, become more faint and obscure by being
 “ emerged in those liquors, and recover their vigour again by being dried, much
 “ after the manner declared of thin bodies, in the tenth and twenty first obser-
 “ vations: and that some of those coloured powders, which painters use, may have
 “ their colours a little changed, by being very elaborately and finely ground.
 “ Where I see not, what can be justly pretended for those changes, besides the
 “ breaking of their parts into less parts by that constitution, after the same manner
 “ that the colour of a plate is changed by varying its thickness. For which rea-
 “ son also it is, that many flowers, by being bruised, become more transparent
 “ than

"than before, or, at least, in some degree or other, change their colours. Nor is it much less to my purpose, that, by mixing divers liquors, very odd and remarkable productions and changes of colours may be effected, of which no cause can be more obvious and natural, than that the saline corpuscles of one liquor do variously act upon, or unite with, the tinging corpuscles of another; so as to make them swell or shrink (whereby not only their bulk, but their density also may be changed) or to divide them into smaller corpuscles, or make many of them associate into one cluster; for we see how apt those saline menstruums are to penetrate and dissolve substances, to which they are applied; and some of them to precipitate what others dissolve. In like manner, if we consider the various phenomena of the atmosphere, we may observe, that when vapours are first raised, they hinder not the transparency of the air, being divided into parts too small to cause any reflection in their superficies: but when, in order to compose drops of rain, they began to coalesce and constitute globules of all intermediate sizes, those globules, when they become of a convenient size to reflect some colours, and transmit others, may constitute clouds of various colours, according to their sizes. And I see not what can be rationally conceived, in so transparent a substance as water for the production of these colours, besides the various sizes of its parcels, which seem to affect a globular figure most; but yet perhaps not without some instability in the smallest of them, by reason that those are most easily agitated by heat or any trembling motions in the air.

"Prop. 6. The parts of bodies, on which their colours depend, are denser than the medium, which pervades their interstices.

"This will appear by considering, that the colour of a body depends not only on the rays, which are incident perpendicularly or its parts, but on those also, which are incident at all other angles. And that, according to the seventh observation, a very little variation of obliquity will change the reflected colour, where the thin body or small particle is rarer than the ambient medium, in so much that such a small particle will, at diversely oblique incidents, reflect all sorts of colours, in so great a variety, that the colour, resulting from them all confusedly reflected from a heap of such particles, must rather be a white or grey, than any other colour, or at best it must be but a very imperfect and dirty colour; whereas, if the thin body or small particle be much denser than the ambient medium, the colours, according to the nineteenth observation, are so little changed by the variation of obliquity, that the rays, which are reflected least obliquely, may predominate over the rest so much, as to cause a heap of such particles to appear very intently of their colour.

"It conduces also something to this proposition, that, according to the twenty-second observation, the colours exhibited by the denser thin body within the rarer are more brisk than those exhibited by the rarer within the denser.

"Prop. 7. The bigness of the component parts of natural bodies may be conjectured by their colours.

“ For since the parts of these bodies, by proposition 5. do most probably exhibit the same colours with a plate of equal thickness, provided they have the same refractive density: and since their parts seem for the most part to have much the same density with water or glass, as by many circumstances is obvious to collect: to determine the sizes of these parts, you need only have recourse to the precedent tables, in which the thickness of water or glass exhibiting any colour is expressed. Thus, if it be desired to know the diameter of a corpuscle, which being of equal density with glass, shall reflect green of the third order; the number $17\frac{1}{2}$ shows it to be about $17\frac{1}{2}$ parts of an inch.

“ The greatest difficulty is here to know, of what order the colour of any body is; and for this end we must have recourse to the fourth and eighteenth observations, from whence may be collected these particulars.

“ *Scarlets*, and other *reds*, *oranges* and *yellows*, if they be pure and intense, are most probably of the second order. Those of the first and third order also may be pretty good; only the orange and red of the third order have too great a mixture of violet and blue.

“ There may be good *greens* of the fourth order, but the purest are of the third: and of this order the green of all vegetables seems to be, partly by reason of the intenseness of their colours, and partly because when they wither, some of them turn to a greenish yellow, and others to a more perfect yellow or orange, or perhaps to red, passing first through all the aforesaid intermediate colours, which changes seem to be effected by the exhaling of the moisture, which may leave the tinging corpuscles more dense, and something augmented by the accretion of the oily and earthy part of that moisture. Now the green, without doubt, is of the same order with those colours, into which it changeth, because the changes are gradual, and those colours, though usually not very pure, yet for the most part are too pure and lively to be of the fourth order.

“ *Blues* and *purples* may be either of the second or third order, but the best are of the third. Thus the colour of *violet* seems to be of that order; because their syrup, by acid liquors, turns red, and by urinous and alkalizant turns green. For since it is of the nature of acids to dissolve or attenuate, and of alkalis to precipitate or incrassate, if the purple colour of the syrup was of the second order, an acid liquor by attenuating its tinging corpuscles would tinge it to a red of the first order, and an alkali, by incrassating them, would change it to a green of the second order; which red and green, especially the green, seem too imperfect to be the colours produced by these changes. But if the said purple be supposed of the third order, its change to red of the second and green of the third may, without any inconvenience, be allowed.

“ If there be found any body of a deeper and less reddish purple than that of violets, its colour most probably is of the second order. But yet there being no body commonly known, whose colour is constantly more deep than theirs.

“ For

" I have made use of their name to denote the deepest and least reddish purples, such as have manifestly transcend their colour in purity.

" The blue of the first order, though very faint and little, may possibly be the colour of some substances; and particularly the azure colour of the skies seems to be of this order. For all vapours, when they begin to condense and coalesce into small parcels, become first of that bigness, whereby such an azure colour may be reflected, before they can constitute clouds of other colours. And so this being the first colour, which vapours begin to reflect, it ought to be the colour of the finest and most transparent skies, in which vapours are not arrived to that grossness requisite to reflect other colours, as we find it is by experience.

" Whiteness, if it be intense, is either that in the first order of colours, of which sort perhaps is the colour of white lead; or else it is a mixture of those succeeding the third or fourth order, such as is the colour of paper, linen, and most white substances. If corpuscles of various sizes, exhibiting the colours of the second and third order, be mixed, they should rather constitute an imperfect whiteness or grey, of which I have already spoken: but yet it seems not impossible for them to exhibit an intense whiteness, if they be disposed to of it. For thus I told you, that froth at a distance hath appeared very white, and yet, near at hand, the several bubbles, of which it was constituted, were seen tinged all over with rings of colours of the four or five first orders.

" Lastly, for the production of black, the corpuscles must be less than any of those, which exhibit colours. For at all greater sizes there is too much light reflected to constitute this colour. But if they be supposed a little less than requisite to reflect the blue of the first order, they will, according to the eighth, seventeenth, and eighteenth observations, reflect to very little light; appear intensely black, and yet may perhaps variously refract it to and within themselves so long, until it happen to be stifled and lost; by which means they will appear black in all positions of the eye without any transference. And from hence may be understood, why fire, and the more dissolvent, putrefaction, turn substances into black; why small quantities of black substances impart their colour very freely and intensely to other substances; which they are applied; why glass ground very elaborately, on a copper-plate till it be well polished, makes the land, together with what is worn off the glass, and copper, become very black; why black substances do soonest multitude of refractions in a little room, and partly from the easy continuation of so very small corpuscles; and why blacks are usually a little inclined to a bluish colour. For that they are so, may be seen by illuminating white paper by reflection from black substances, which will usually appear of a bluish white. And the reason is, that black borders on the obscure blue of the first order, described in the eighteenth observation, whence the corpuscles of black substances are most apt to reflect that colour.

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"In these descriptions have been the more particular, because it is not impossible, but that microscopes may at length be improved to the discovery of corpuscles or bodies, on which their colours depend. For if those instruments could be so far improved, as with sufficient distinctness to represent objects five or six hundred times bigger than at a foot distance they appear to our naked eyes, I should hope, that we might be able to discover some of the greatest of those corpuscles. And by one, that would magnify three or four thousand times, perhaps they might all be discovered but those, which produce blackness. In the mean while, I see nothing material, that rationally can be doubted of. In the ing this position, that transparent corpuscles of the same thickness and density with a plate do exhibit the same colour. And this I would have understood not without some latitude, as well because those corpuscles may be of irregular figures, and many rays must be obliquely incident, and so have a shorter way through them than the length of their diameter; as because the straightness of the medium, pent in on all sides, may a little alter its motions, or other qualities, on which the reflexion depends. But yet I cannot much suspect, except because I have observed of some small plates of Mulcovy-glass, of other quadrangular, an even thickness, that through a microscope they have appeared the last, colour at their edges and corners, where the included medium was terminated, which they appeared of in other places. However, it would add much to our satisfaction, if those corpuscles could be discovered with microscopes, which if we shall ever attain to, I fear it will be the utmost improvement of this sense; for it seems impossible to see the more secret and noble works of nature within those corpuscles, by reason of their transparency.

"This may suffice concerning the constitution of natural bodies, on which their colours depend. But for further understanding the nature of reflexions, I shall add these two following propositions.

"Prop. 8. The cause of the reflexion is not the impinging of light on the solid and impervious parts of bodies, as is commonly supposed.

"This will appear by the following considerations: first, that in the passage of light out of glass into air, there is a reflexion as strong or stronger than in its passage out of air into glass, and by many degrees stronger than in its passage out of glass into water. And it seems not probable, that air should have more reflecting parts than water or glass. But if that should possibly be supposed, it will avail nothing; for the reflexion is as strong, if not stronger, when the air is drawn away from the glass (suppose in the air-pump invented by Mr. Boyle) as when it is adjacent to it. Secondly, if light in its passage out of glass into air be incident more obliquely than at an angle of forty or forty-one degrees, it is wholly reflected; if less obliquely, it is in great measure transmitted. Now it is not to be imagined, that light at one degree of obliquity should meet with pores enough in the air to transmit the greater part of it, and at another degree of obliquity meet with nothing but parts to reflect it wholly; especially considering, that in its passage out of air into glass, how oblique soever be its incidence, it finds pores enough to transmit the greatest part of it.

" If any man suppose, that it is not reflected by the air, but by the utmost superficial parts of the glass, there is still the same difficulty; besides, that such a supposition is unintelligible; and will also appear to be false, by applying water behind some part of the glass instead of air. For so in a convenient obliquity of the rays, suppose of forty-five or forty-six degrees, at which they are all reflected, where the air is adjacent to the glass, they shall be in great measure transmitted, where the water is adjacent to it; which argues, that their reflection or transmission depends on the constitution of the air and water behind the glass, and not on the parts of the glass.

" Thirdly, if the colours made by a prism, placed at the entrance of a beam of light into a darkened room, be successively cast on a second prism placed at a great distance from the former, in such manner that they are all alike incident upon it; the second prism may be so inclined to the incident rays, that those, which are of a blue colour, shall be all reflected by it; and yet those of a red colour pretty copiously transmitted. Now if the reflection be caused by the parts of air or glass, I would ask, why at the same obliquity of incidence the blue should wholly impinge on those parts so as to be all reflected, and yet the red find pores enough to be in great measure transmitted. Fourthly, where two glasses touch one another, there is no sensible reflection, as was declared in the first observation; and yet I see no reason, why the rays should not impinge on the parts of glass, when contiguous to another glass, as much as when contiguous to air. Fifthly, when the top of a water-bubble (in the seventeenth observation) by the continual subsiding and exhaling of the water grew very thin, there was such a little and almost insensible quantity of light reflected from it, that it appeared intently black; whereas, round about that black spot, where the water was thicker, the reflection was so strong as to make the water seem very white. Nor is it only at the least thickness of thin plates or bubbles that there is no manifest reflection, but at many other thicknesses, for an intermediate number of successions. And yet in the successions of the third body, where it is of any one thickness, there are as parts for the rays to impinge on, as where it is of any other thickness.

" Lastly, if reflection were caused by the parts of reflecting bodies, it would be impossible for thin plates or bubbles, at the same place to reflect the rays of one colour, and transmit those of another, as they do according to the thirteenth and sixteenth observations. For it is not to be imagined, that at one place rays, which, for instance, exhibit a blue colour, should have the fortune to impinge upon the parts, and those, which exhibit a red, to hit upon the pores of the body; and then at another place, where the body is either a little thicker, or a little thinner, that on the contrary the blue should hit upon its pores, and be reflected, and the red upon its parts.

" Prop. 9. It is most probable, that the rays, which impinge on the solid parts of any body, are not reflected but stifled and lost in that body.

" This

" This is consentaneous to the precedent proposition, and will further appear
 " by considering, that if all the rays should be reflected, which impinge on the in-
 " ternal parts of clear water or crystal, those substances should rather have a cloudy
 " than so very clear transparency.

" And further, there would be no principle of the obscurity or blackness, which
 " some bodies have in all positions of the eye. For to produce this effect, it is ne-
 " cessary, that many rays be retained and lost in the body, and it seems not pro-
 " bable, that any rays can be stopped and retained in it, which do not impinge on
 " its parts."

February 17. Mr. OLDENBURG produced and read divers experiments made
 in the air-pump at Paris, by Monf. HUYGENS and Monf. PAPIN, upon divers
 insects, and upon the lungs of animals: as also upon gun-powder, to find what
 quantity of air there is in that body, and to what degree it was compressed there-
 in, &c.

Of these experiments it was ordered, that the lungs of a lamb, newly killed,
 should be kept for the next meetings, and tried in the exhausting engine, after the
 manner observed by Monf. HUYGENS.

February 24. The experiment ordered for this meeting was tried, viz. the lungs
 of a lamb, after they had been put in water, and found to float, were blown up,
 and then put into the air-pump together with a gage: where, upon the first suc-
 ceptions, they swelled to a certain degree, and the air being well exhausted, they
 continued on, during the succeeding motions of the engine. Then the air being sud-
 denly admitted again, the lungs presently contracted into a small bulk, and being
 taken out looked redder, and being thrown into water, sunk to the bottom.
 This was tried twice with the like success, though the second time they sunk not
 so deep as the first.

Monf. HUYGENS affirmed, that lungs having been put between two plates, with
 a considerable weight thereon, he had not been able so to express the air out of
 them, as to make them sink in water, though upon the exhausting of the air in
 the engine, and the admitting it again upon the lungs, they sunk.

The reason of this being enquired into by the members, Dr. CROWE alleged,
 that the air, by its subtilty, was able to get every where equally to all the parts,
 inward and outward, of the lungs, and by an equal and universal pressure on them,
 lay flat and close all the vessels thereof, which a weight laid only on the super-
 ficial parts of the lungs was not able to do.

It was ordered, that at the next meeting this experiment should be made of
 putting lungs between two plates, with a weight thereon, to see, whether it would
 not compress them so as to make them subside in water.

* These experiments are published in the Philosoph. Transf. vol. 2. n^o 122. p. 145.
 Vol. III.

Mr. OLDENBURG read a paper sent to him from Dr. ERASMUS BARTHOLIN, professor of mathematics at Copenhagen, containing the answers of a bishop of Iceland, named GISLAVUS THORLACUS, to several queries formerly sent thither by order of the Society¹.

" Ad Quæst. 1. Omnes liquores tenues, aquosi, & serosi, hic congelantur: merus sanguis etiam congelatur, forsitan ob terrestrem sui partem majorem. Vix na quæ novimus dilutiora, hic quidem congelantur, sed fortiora vix id passura: puto; sic nec lixivia saponariorum fortia, nec spiritus mercurialis salium. &c.

" tificatos (ut vocant) neque sulphureos ex vino.

" De argento vivo frigori exposito num aliquam mutationem recipiat, non satis compertum habeo, verisimile tamen est, aliquo modo condensari.

" Olea pura potius incrassari & condensari, quam in glaciem converti, existimo.

" Ad 2. Frigus terram ad sex vel septem pedum, aquam vero stagnantem ad trium circiter pedum profunditatem, hic penetrare putatur.

" Ad 3. Horologiorum artificialium apud nos nullus est usus.

" Ad 4. Colores frigore summo concentrari posse, nullus dubito.

" Ad 5. De alteratione virium magnetis & succini per acre gelu nondum compertum habeo.

" Ad 6. Omnia metallica & lapidea fragiliora redduntur ab acri gelu, & tepefactione habent opus, quo redeant ad priorem naturam.

" Ad 7. Anatomicorum (qui nulli hic sunt) observationibus prorsus tuimur.

" Ad 8. Omnes grumi glaciales, qui ad hanc insulam ex Gronlandia viris & ventorum deferuntur, fiunt ex aqua dulci maris, & continuis accrem nivium, quorum nonnulli ad trecentarum ulnarum vel sexcentorum pedum altitudinem surgunt; tertia tantum parte supra aquam existente.

" Ad 9. Fontes in Islandia calidi reperiuntur quam plurimi, nullam ciem tolerantes, quorum nonnulli adeo fervent, ut omne munus ignis foci explere possint; puta tingendis pannis & coquendis cibis, etiam crassissim ut carnibus, piscibus, &c.

" Ad 10. Figuram nivis non exacte observavi, grandinis autem figura se rotunda est, & granum piperis magnitudine sua rarius excedit.

¹ Letter-book, vol. vii. p. 182.

"Ad 11. Corpora quaedam reservari posse nive, ut ova, crudas carnes, pisces
"recentes, &c. colore vel sapore non multum variante, non diffido, sed hume-
"fieri potius quam contrahi existimo.

"Ad 12. Circa fulgura, tonitrua, aliaque meteora, nihil notabile habeo, nisi
"quod tonitrua etiam hyberno tempore hic nonnunquam exaudiantur, idque
"in meridionali potissimum insulae parte, ubi etiam terrae motus sunt fortiores,
" & frequentiores.

"Ad 13. Venti septentrionales apud nos frequentissimi sunt, & post hos
"etiam meridionales, ceteri autem rariora. Effecta autem eorumundem variant
"juxta varium locorum situm; etenim occidentales venti, in occidentali Islandia
"aqua, qui in orientali insulae parte sunt sicci, & contra in orientali Islandia
"dix; orientales venti sunt humidi, in occidentali autem sicci. Eadem est ra-
"tio de septentrionalibus ventis in meridionali & septentrionali insulae parte.

"Ad 14. Mons Hecla, qui annos jam quadraginta circiter siluit, neque
"ignem vel flammam tanto temporis spatio emisit, nihil fere notabile habet, neque
"que tempestatum mutationem praesagit, pumices potissimum suppeditat.

"Ad 15. Refractio in aere a nullo adhuc, quantum existimo, accurate ob-
"servata est: diameter solis & lunae longior hic apparet quam in Danica, & in
"aliis meridionalibus regionibus. Pleiades quinque tantum stellas hic habet;
"luna altero post conjunctionem die ut plurimum conspicitur.

"Ad 16. Eclipsium observationem quantum poterimus pollicemur.

"Ad 17. Non adeo curiose notatum est hactenus, quanta copia salis ex coc-
"tione aquae marinae exire possit, cum a nullo, quod sciam, hic tentata sit,
"nisi tantum a spectatissimo viro C. S. SLAVIO Magni filio, qui tricesimam vel qua-
"dragesimam aquae partem in salem converti existimat.

"Ad 18. De tempore autem aestuum marinarum, in diversis portubus, item
"de altitudine, tempore, ac duratione, ejusdem aestus marini, ut & de mineralibus,
"plebis, aliisque fossilibus his provenientibus (de quibus quaest. 15.) aliquid vo-
"lente Deo, addam, postquam de his certius edoctus fuero.

"Ad 19. Declinationem acus magneticae, Notae, quae sedes est episcopalis,
"in boreali Islandia observavi quindecim circiter graduum, latitudo ejusdem loci
"est 66, 43.

"Ad 20. Ferrum ferruginem citissime hic contrahit, praesertim in meridionali
" & maritima insulae parte.

"Ad 21. De animalibus tam feris, quam domesticis videri potest disputa-
"tio M. THEOPHORI THORLACII de Islandia, Sect. 4. Theor. 6.
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 " Ad 22. Herbarum & fructicum plurimas species terra Islandica producit,
 " arborum autem præter betulam nullas.

" 23. Jumenta cum ovium caprarumque grege tempore hyberno solo fœno
" pascuntur, astate autem gramine viridi.

⁴⁴ Ad 24. Colores animalium hic diversi sunt, sed frequentissimus est albus.

" Ad 25. Morbus præcipuus, quo laborant Islandi, est epidemicus, nostræ
" lingua (Landfarfootts) quo morbo laborantes capitis dolores cum pluritudine præ-
" cipue sentiunt.

" Ad 26. Plumæ, quas *ardardum* vulgo vocant, colliguntur ex nidis avium
 " quarundam marinarum, quas *æder* appellant Islandi, & plumulas tales a pro-
 " riis pectoribus avellunt: avis est ex anatium genere, anate major, sed minor
 " anser.

" Ad 27. De monocerote marino (quod piscis genus hic admodum rarum est)
" non nihil dictum est, quoad staturam & nomenclaturam, in dissertatione de
" islandia. Thef. 6. Sect. 4."

Sir WILLIAM PETTY taking particular notice of the quantity of salt or brine, which in these answers was said to be contained in salt-water, and noting also what was said of the icy mountains being congealed only or mostly of fresh-water, suggested, that frost might serve to make strong brine, the fresh-water mingled with the salt-water being frozen, and successively taken off, and the remainder exposed again to freeze, till there remained nothing but a mere brine.

It was ordered, that a solemn letter of thanks should be returned to this brother of Iceland, and that he be desired to favour the Society with an experimental answer to those queries, which in this paper were answered only from his conjectures.

March 2. Sir RICHARD EDGECOMBE was proposed candidate by Sir ROBERT REDDING.

Dr. CROUNZ gave an account of the experiment ordered at the last meeting which was, that though no lungs had been tried to be squeezed together with weight, yet the operator had laboured to do it with both his hands as forcibly as could, but had not been able thereby so to press out the air, as to make the lungs sink.

After this there was tried this experiment before the Society by Dr. CROWE, the lungs of a sucking rabbit were taken out by him as carefully as he could, having ready a wide-mouthed glass filled with water, and a lead fastened to the larynx, he blew them up under the water, and stopped the quill, which was fastened in the trachea, with cement, and then being kept still under the water by the lead

lungs, glass, and all were put under a receiver, and so the pump was plied: whereupon the lungs presently expanded, and, as before, continued to do so at a certain degree for some time, a train of bubbles breaking out at first, as it seemed, out of the side of the lungs, yet without any hurt or wound on that side. Afterwards they appeared to break out round about and every where out of the lungs. At length many bubbles rose also from the bottom of the water; and withal a number of very small bubbles continued to rise every where round the lungs, as if they sprung out of its natural pores. All this while the lungs in the water looked as white as any lungs do, that are blown up. Then letting in the air suddenly, the lungs soon became much less in bulk, and presently sunk to the bottom, and when taken out appeared considerably red.

Mr. HOOKE mentioned, that there had been lately with him a person, who had suggested to him some new notions concerning the loadstone, viz. that the motions of it would vary and change far otherwise than hitherto had been taken notice of, so as that the variation of it would be for a quarter of a year to the north, and the next quarter to the west of the north; and particularly that the twenty-ninth of February preceding it would be four degrees to the eastward. Mr. Hooke added, that he intended to observe it, having already made a meridian for that purpose, and to give the Society an account of the result of his observations.

Mr. OLDENBURG moving, that now the sun and season being likely to serve for the making of Mr. Newton's experiment called in question by Mr. LINNÆUS, an apparatus might be prepared for that purpose; Mr. Hooke said, that he had an apparatus ready to make the experiment, when the Society should call for it.

March 6: At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,
The lord bishop of Chester,
Mr. secretary WILLIAMSON,
Sir PAUL NEILE,
Sir JOHN BANKES,
Sir CYRIL WYCHE,
Sir ROBERT SOUTHWELL,
Dr. HOLDER,
Dr. PELL,

Mr. HENSHAW,
Mr. COLWALL,
Mr. MILLIS,
Dr. CROUNE,
Dr. GREW,
Mr. HILL,
Mr. OLDENBURG.

The president moved, that it might be considered how to provide for the weekly meetings of the Society a sufficient number of experiments to be made from time to time, and to pitch upon such persons, as might be depended upon for the exhibiting of them.

After some debate it was ordered, that Sir JOHN BANKES, Sir CYRIL WYCHE, Sir JONAS MOORE, Mr. COLWALL, Dr. CROUNE, Dr. GREW, Mr. MILLIS, or any three or more of them (whereof the treasurer, Mr. COLWALL, to be taken, and so on)

many more of the council, as should please to join themselves with them, be a committee for considering of persons, members of the Royal Society, fit to entertain the said Society at their weekly meetings from time to time with experiments, and discourses upon them, to be left in writing, in order to be registered: and having found such persons, as were able, and would engage in this work, to offer to them for every such experimental exercise performed before the Society, and delivered in writing, a sum of money not exceeding the value of four pounds: besides the charges requisite to make the respective experiments: and this committee to meet in the Society's repository on Thursdays, at three o'clock precisely, and to make a report of their progress in this matter to the council.

A proposal concerning Chelsea College was made by Mr. OLDE BURGO person, who would not yet be named, desiring a lease of the house and land in possession for thirty-one years, at thirty pounds *per annum*, or for fifty years at thirty-five pounds *per annum*, and in both cases to make the house *fit for habitation* at his own convenient speed.

The council declared hereupon, that it was a fair proposition to treat upon; and that they would appoint a committee to do so, when they should understand, that the proposer was returned from Cambridge, whither, they were informed, he was gone.

Some of the council moved, in the mean while, that the proposer might be obliged not to put the house to any other use than had been now named by Mr. OLDENBURG, which was to practise chemical operations, to make a physic-garden, and a repository for natural curiosities, without obtaining leave from the council: otherwise the lease to be void.

There was then read a proposal for encouraging the press of Oxford, recommended by Sir JOSEPH WILLIAMSON, secretary of state, to the council, viz. to fix upon some good book or books to be printed there at a reasonable rate, such time as five hundred subscribers should be obtained.

The council declared, that they would consider of some books to be printed accordingly, and thereupon offer and recommend the paper produced to particular persons of their number for subscriptions, and to do the like to the body of the Society.

After this, the committee for managing the repository of the Society made report to the council of what they had done in that affair, viz. that they had moved the particulars thereof out of the rooms, where they had hitherto been, into the gallery at the west end of Gresham College, and there ranged them in order: and that it now remained only for the council to order an inventory or catalogue to be made both of those curiosities and the books, and to appoint persons to have the custody of the same.

Whereupon it was ordered, that Sir JOHN BANKES, Sir CYRIL WYCHE, Sir JONAS

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JONAS MOORE, Mr. MILLES, Mr. DANIEL COLWALL, Dr. CROUNE, Dr. GREW, Mr. HILL, for any or more of them (whereof Mr. COLWALL to be one) be a committee for considering of persons, who might be fit to make an inventory or catalogue, not only of the natural curiosities and books of the Royal Society, but also of all the Goods and chattels belonging to the same, and to cause all those particulars to be entered in a book: and likewise to fix upon a trusty person to be keeper of all the things above mentioned, and to represent the result of all to the council.

The treasurer moving, that for the future he might not pay any salary to the respective officers of the Society without an order from the president, it was ordered,

That for the future, the treasurer, do not pay any salary to any officers of the Society without an order from the president.

Mr. HENSHAW desiring to borrow for the use of some learned friends of his out of the Arundelian library given to the Society, the MS. of St. CYPRIAN, for the restoring of which he would engage himself by a note under his hand; it was ordered, that Mr. HOOKS should deliver to him, as soon as conveniently he could, the said MS. Mr. HENSHAW giving to Mr. OLDENBURG a note under his hand to restore it safe and undamaged, within the space of six months from the date hereof: and that this order be signed by the president.

N^o 122. of the *Philosophical Transactions* was licensed.

March 9. At a meeting of the SOCIETY,

An experiment was made, upon Mr. BOYLE's suggestion, with a bolt-head glass sealed up hermetically, put in water and in a receiver in the engine, to see whether the bubbles, which at the last meeting were seen to rise very copiously and frequently about the lungs, would do the like about the glass. It was found, that they rose about it very soon after the pump was begun to be plied, and that bubbles settled themselves copiously upon the glass round about it, but by little and little broke off from it.

Mr. OLDENBURG produced a paper, sent to him in a letter from Sir PHILIP SKIPTON, being a relation of Virginia, and containing a short natural history of that country, viz. the geography of it, a description of the river there, together with the several sorts of fishes, which they afford; as also of the mountains of Virginia, and the attempts made to discover, whether on the back of them were any rivers running into the South Sea: likewise of the mines, soil, herbs, timber, and fruit-trees, cattle, deer, wild beasts; and, lastly, of the Indian

It was drawn up by Mr. THOMAS GLOVER, a chirurgeon; and is printed in the *Philosoph. Trans.* vol. 20. n^o 126. p. 623. for June, 1676.

WYCHE, Sir
JONAS

inhabitants themselves, their small numbers, their way of cloathing, building, hunting, fishing, divine worship, money, diseases, way of physic, and manner of planting and ordering tobacco.

March 16. There was read a large letter to Mr. OLDENBURG from Mr. FRANCIS VERNON, dated at Smyrna, 10th January, 1675, giving a summary account of the observations made by him in his travels from Venice through Istria, Dalmatia, Achaia, Morea, and the Archipelago to Smyrna^a, and taking notice of Monsi. De la GUILLIETIERE's description of Athens, as containing many mistakes and falsities, though plausibly written.

Divers members expressed their desires, that this letter of Mr. VERNON might be printed.

Occasion being given of discoursing about the cause of the ascent and descent of the spirit of wine in sealed thermometers, and that being ascribed by some of the members to particles of air interspersed in the liquor, it was ordered, that at the next meeting some spirit of wine should be put into the air-pump, and the air of it exhausted, and thereupon such purged spirit be presently sealed up in a fit and well-wrought glass-cane, and another such cane of the same size and shape every way be ready to be filled with spirit of wine unexhausted, in order to see the manner and difference of their working together.

It was ordered also, that Mr. NEWTON's experiment, questioned by Mr. LUNUS, should be made at the next meeting, if the weather should prove favourable for it.

Mr. OLDENBURG presented to the Society his tenth volume of the *Philosophical Transactions* for the year 1675.

March 23. There was no meeting of the Society.

1676, March 30. There was no meeting of the Society on account after holy-days.

April 6. Mr. OLDENBURG delivered the box formerly sent to the Society by Dr. SWAMMERDAM, containing an uterus, and the neighbouring parts, to be prepared with wax syringed into the vessels thereof, that the parts of connection might be distinctly seen; together with the arteries and veins of man spleen and those of a calf, part of the *intestini jejuni valvulae conniventes*, of the *portio cuticulae* of a penis & urethra, and a *phobicum peculiare ex abdomine gallinae*: besides, upon a paper delineated, the *arteria primi generis seu pulmonalis in piscibus*, per quam sanguis ad branchias ascendit, and the *arteria secundi generis in piscibus*, per quam sanguis e ramis branchiarum immediate per eorum corpus distribuitur.

^a It is printed in the *Philosoph. Transact.* vol. xi. n^o 124. p. 575. for April, 1676.

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Mr. OLDENBURG read a letter to himself from Mr. HERRIUS, dated at Dantzick, 11th March, 1672, complaining of the animadversions made by Mr. Hooker upon his *Machina celestis*, and intimating his resolution to answer them; sending also an observation of his of a phenomenon of Saturn made 14th August, 1675, wherein the body of that planet appeared beneath the ring; together with his observation of the solar eclipse of 23d June, 1675.

A committee, consisting of Sir JONAS MOORE, Dr. CROWE, Mr. HILL, Dr. GREW, and Mr. HOOKE, was appointed to try Mr. NEWTON's experiment contrived by Mr. LINUS; and it was ordered, that after the trial of it by that committee, it should be made before the Society.

April 13. There was read a letter in Latin from Signor TRAVAGLIO, dated at Venice, 24th March, 1675, addressed to the Society, returning them thanks for his election into their body.

Dr. GREW presented the Society with an experimental discourse, in pursuance of one part of his former lecture, concerning mixture, such a branch of philosophy, as might give great light into the nature of bodies. The design of this discourse, and the experiments attending it, was to observe the luctation, that arises from the mixture of several liquors with vegetable, mineral, and animal substances; the author undertaking in that discourse vegetables and minerals, and referring animal substances for another time, and distinguishing the several ways and effects of this luctation, viz. ebullition, elevation, crepitation, effervescence, and exhalation. The liquors employed were eight or nine, viz. spirit of sal armoniac, spirit of hart's-horn, spirit of scurvy-grass, spirit of wine, spirit of sal armoniac, spirit of salt, oil of sulphur, oil of vitriol, aqua fortis, spirit of nitre, spirit of these liquors were infused, were about an hundred. The materials, upon which

It was desired, that this discourse might be registered*, and, when finished, printed.

April 27. The experiment of Mr. NEWTON, which had been contested by Mr. LINUS and his fellows at Liege, was tried before the Society, according to Mr. NEWTON's directions, and succeeded, as he all along had asserted it would do; and it was ordered, that Mr. OLDENBURG should signify that it would be before the Society, and succeed, according to Mr. NEWTON's assertions, they would acquiesce, as appears by Mr. GASCOIGNE's letter to Mr. OLDENBURG of 15th December, 1675.

The experiment was thus: a prism was taken, and so held, that its axis was perpendicular to the sun's rays (it being a very clear sun-shine day) and in this

* Both these observations are printed in the Philosophical Transactions, vol. II. n. 127. p. 610, 601, for July, 1676.

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Register, vol. V. p. 18.
It is printed in his Anatomy of Plants, book 2. p. 238.

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posture it was placed in a darkened room, as close as might be to the hole, through which the sun shined into the dark room; which hole was about the bigness of a pea. Then the prism was turned slowly about its axis, and the colours were seen to move upon the opposite wall, first towards that place, to which the sun's direct light would pass, if the prism were taken away; and then back again. When the colours were about the middle of these two contrary positions, that is, when they were nearest to that place, to which the sun's direct rays tended, there the experimenter stopped, the rays being then equally refracted on both sides the prism. In this posture of the prism, the figure of the colours being observed, it was found not round, as Mr. LINNUS contended, but oblong; the colours red, yellow, green, blue, purple, succeeding in order, not from one side of the figure to the other, as in Mr. LINNUS's conjecture, but from one end to the other, and the length of the figure being not parallel, but ~~transverse~~ transverse to the axis of the prism.

Dr. CROUNE gave an account of the experiment of exhausting the air out of spirit of wine, and of comparing it then with such spirit unexhausted, to see the difference of its working in sealed thermometers. He said, that that spirit thus exhausted was more sluggish by a fourth part than that, which was not exhausted.

The president ordered, that it might be tried again before him, being of opinion, that the difference of the working would be greater, if the air were more exhausted.

Dr. CROUNE took notice of an experiment made and published by Mons. HUYGENS, in 1672, viz. whether the effect of a syphon of unequal legs, by which the water of a vessel is made to run over, is ascribed to the weight of the syphon run, after the recipient was exhausted of air; and found also with water purged of air it produced the like effect as well as without the recipient; he affirming withal, that the recipient was well exhausted of air having assured himself of that, as well by finding, that there came not more through the pump, and by other more sure marks: which experiment he for a confirmation of his opinion, that there is, besides the air, a pressing more subtil than the air.

Mr. HOOKE hereupon affirmed, that he could do the same with quicksilver, make it run out of a syphon after the air was well exhausted.

The president desired to see that experiment.

Mr. OLDENBURG presented the Society with a manuscript of Mons. Joly Dijon, containing a body of mechanics, in which he pretended to have found demonstrated an universal principle to explain the effects of the moving power of engines, desiring the Society's judgment thereof. Upon which the president Sir CHRISTOPHER WREN, Sir JONAS MOORE, Dr. WALLIS, Dr. PELL, Dr. CROUNE,

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CROUNES, and Mr. HOOK, were desired to read it over, and consider it, and make a report to the Society. 315

The president informed the Society, that a bitch of his, that was unspleened some years ago, had been opened the other day, and nothing of any succedaneum found in the place of the spleen.

May 4. being Ascension-day, the Society did not meet.

May 11. There was made before the Society by WILLIAM COLE, M. D. an observation about the intestines of animals. viz. that the structure of their fibres is not annular, as had been before generally received, but spiral.

The observation was shewn in the colon of a sheep, and the discoverer's written account thereof^m read. But because the meeting was very thin, and neither the president nor vice-president in the chair, it was thought proper to repeat both the observation and discourse at a fuller meeting for farther examination; the author being desirous to have the judgment of the Society upon both.

May 18. Mr. HALL was admitted fellow.

Dr. GREW produced an account of a woman breeding stones in great quantities of different sorts, and voiding them, partly by vomit, partly by the urinary passages; some great, some little, whereof the little ones looked like small white pebbles; others friable like gritty stones, and of the colour of fullers earth.

He remarked, that having poured spirit of nitre upon both sorts of these stones, he found, that it wrought upon the greater stones, but not upon the pebbles: whence he conjectured, that since it was not likely, that in one and the same body should be bred stones of so different natures, as all other stones observed by him make an effervescence with some acid or other; it might be, that this woman by an irregular appetite had chewed and eaten one sort of these stones, which afterwards by some viscid matter were concreted together in the body; by virtue of which viscid matter mixed with the stones alone it was, that those stones thus concreted made the said effervescence.

Mr. OLDENBURG produced several papers communicated to him; that Dr. BEAL, containing two instances of something remarkable in shining flesh*: the second from MONS. LEIBNITZ, concerning sparks seen in an old baroscope upon agitation: the third from Dr. COLC, concerning the spiral, instead of the hitherto supposed annular structure of the fibres of the intestines.

As to the first, it being mentioned, that a warm and moist air might contribute to the production of such a phenomenon, the president said, that since we were

* It is printed in the Philosoph. Transact. vol. xi. n. 115. p. 603. for May, 1676.

This paper is printed in the Philosoph. Transact. vol. xi. n. 125. p. 599.

masters of such a cause, it were worth trying, whether such a phenomenon could be raised from it.

As to the second, the president intimated, that he would exhaust all the air out of the mercury, and make a mercurial tube stand top-full, and then make it fall down, and so observe, whether any such light appeared.

For the third, the operator was ordered to boil the colon of a sheep's gut on the Thursday following four hours immediately preceding the Society's meeting, that so it might be produced there for making the observation of Dr. Cole.

Mr. AUBREY acquainted the Society, that he had received from Sir FRANCIS BACON some manuscripts of Mr. FOSTER*, for their perusal. It was only desired, that the Society would give assurance to see them returned, when they had done with them, to Mr. OVERTON, from whom they had been obtained by the solicitation of Mr. ANDREW PASCALL, rector of Chedsey in Somersetshire.

Hereupon the Society ordered, that Mr. COLLINS should be desired to peruse these manuscripts, and make a report of them to the Society: and that they should be faithfully returned to Mr. OVERTON, as soon as the Society had done with them.

The titles of the MSS. as taken out of Mr. PASCALL's letter to Mr. AUBREY, dated at Chedsey, 7th April, 1676, were as follows:

1. *Motuum & eclipsium solis & lune computatio trigonometrica juxta hypothesis Lansbergii ad canonem arithmetice formam redacta; cui præfigitur problematum etiam primi motus (quæ ad eclipses spectant) solutio.*

2. *Kepleri præceptum 25 illustratum, demonstratum, resolutum.*

3. A general instrument described, and the use declared in the working of portions of eight several kinds, i. e. of, 1. Numbers or equal parts. 2. Lines and superficies. 3. Equal parts and solids. 4. Equal parts and tangents. 5. Sines with sines. 6. Sines with versed sines. 7. Sines with equal sines with tangents.

4. A lecture about the sun's motion; *descriptio Præli de* * *

5. *Explicationes in tabularum Rudolphinarum capita quatuordecim.*

6. *Novologiorum scialericorum descriptiones variae.*

7. *Ad commentarios sæclæris & radii, ut & eminentissimarum propositionum præmissarum.*

* Mr. SAMUEL FOSTER, professor of astronomy in Gresham college, who died in July, 1652. Dr. WARD'S Lives of the Professors of Gresham college, p. 85.

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8. Part of Mr. GUNTER's book explained, of the sector.

9. The first book of geometry of problems, in the structure whereof only circles and right lines are used.

10. The second book of geometry, of the nature of crooked lines: and the third of the construction of problems, that are solid.

The president nominated and appointed the lord bishop of Chester, Sir JONAS MOORE, Dr. JOHN PELL, and Dr. WALTER NEEDHAM to be vice-presidents of the Society.

June 1. Sir THOMAS CLUTTERBUCK was proposed candidate by Mr. OL-
DENBURG.

Mr. SMETHWICK gave an account of the sun's eclipse observed by him that morning, as follows:

Initium defectionis Hæmonæherii - - - - - b. 7 50' ? *Post medium noctem*
Finitis - - - - - 9 54½ *June 1, 1676.*
Solius eclipsæ duratio horæ 2 4½.

The observation was made by a second pendulum corrected by two days observations, and a tube of seven feet and a half.

According to this observation the eclipse began sooner by 4', and ended sooner by 8', than Mr. FLAMSTEAD had predicted in the Royal Almanack.

It was ordered that Mr. FLAMSTEAD's and Mr. STREET's observations should be inquired after.

One Mr. BOWLAND, who had lived at Tangier for six or seven years, shewed the Society some observations about the tides and current of the Straits, viz. that there is in the Straits mouth not only a current, but also a constant flux and reflux following the motion of the moon, concerning which he promised to give the Society his particular observations proving the matter of fact.

Mr. OLDBURG read a letter written to him from Dublin, dated 10th May, 1676, by Mr. HENRY NICHOLSON, relating a strange effect of thunder upon a magnetic sea-card, whose north and south points had changed positions in such a manner, that though the master of the ship had with his finger brought the flower de lys to point directly north, it would as soon as at liberty return to the new unusual posture. Besides, upon examination it was found, that every compass in the ship was of the same humour.

It is printed in the Philosoph. Transact. vol. xi. n^o 116. p. 637.

It is printed in the Philol. Transact. vol. xi. n^o 117. p. 647.

was said to be the master of the ship, to which this accident happened; and Mr. HOWARD, master of several ships, and a man of good credit, was the relater of this accident.

It was ordered, that these persons be inquired after and examined concerning the truth of this relation.

Dr. GREG entertained the Society with his discourse concerning the operation of spirit of nitre and oil of vitriol upon animal bodies, both of the exterior and interior parts of them. The exterior were hairs, nails, hoofs, and horns, shells, shelly insects, teeth and other bones, flesh, and all the viscera, blood, musk, civet, sperma ceti, gall, wine, salt of blood, of hartshorn, of wine, tartar of wine, stones, as of the bladder, of the gall, bezoar, western and oriental, of stones extraordinary voided by a woman in Hereford.

He was thanked for his discourse, and desired to give it to be entered and printed with his former discourse.

June 8. Three letters were read,

1. Written at Liege, 27th May, 1676, by Mr. LUCAS, successor in the mathematical professorship there to Mr. ANTHONY LINUS, containing partly an account of the success of Mr. NEWTON's experiment there; partly some new objections against Mr. NEWTON's theory of light and colours.

This letter was ordered to be copied, and the copy to be immediately sent to Mr. NEWTON at Cambridge for his answer thereto.

2. A letter from Mr. BOUCHIER to Mr. EDMUND HALLEY from Jamaica, 10th March, 1676, communicated by the latter to Mr. OLDENBURG, giving account of divers remarkable particulars in that island, its salubrity, produce and fitness for astronomical observations, there being scarce two cloudy nights whole year.

3. A letter from Mr. HENRY NICHOLSON, dated at Dublin, 20th May, relating a strange effect of thunder upon a magnetic sea-card, its north and points having changed positions irrecoverably; and containing likewise some observations about the alteration of the temperature of Ireland and other countries, as also the contrivance of an hygroscope; together with an experiment proper for discovering the use of respiration; and some observations concerning the African flying harr, and the strong musky scent of the animal called musk-quadrant.

There was also read Mr. COLSON's observation of the late solar eclipse of June made at Wapping.

¹ Register, vol. v. p. 147.

² It is printed in his *Account of Plants*, p. 247.

³ This letter is printed in the *Philos. Trans.* vol. xi. n° 128. p. 692.

⁴ This letter is printed in the *Philos. Trans.*

n° 127. p. 647. & seq.

⁵ Ibid. n° 126. p. 637.

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June 15. There were read two letters, the one written by Mr. HENRY HALL to Mr. OLDENBURG out of Gloucestershire, giving an account of the iron and coal mines in the forest of Dean.

The other letter was from Mr. NEWTON, dated at Cambridge, 13th June, 1676, containing partly a general answer to Mr. LUCAS's letter, with a promise of a particular one; partly some communications of an algebraical nature for Monf. LEIBNITZ, who by an express letter to Mr. OLDENBURG had desired them.

July 18. At a meeting of the COUNCIL were present

Sir ROBERT MOORE, vice-president, in the chair,
Dr. CROUNE, Sir JONAS SOUTHWELL, Mr. COLWALL,
Mr. OLDENBURG.

It was ordered, that n° 127 of the *Philosophical Transactions* with two tables of cuts be printed by the printer of the Society.

October 3. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,
Sir JONAS MOORE, Dr. GREW,
Dr. HOLDER, Mr. MILLES,
Mr. COLWALL, Mr. OLDENBURG.

It was ordered, that n° 128 of the *Philosophical Transactions* with two tables of cuts be printed by the Society's printer.

The president was put in mind of Giving order for summoning the Society to meet again; which his lordship said he would do on the first Thursday in the approaching term, October 26.

October 12. At a meeting of the COUNCIL were present

The lord viscount Brouncker, president,
Sir PAUL NEILE, Mr. COLWALL,
Dr. PELL, Mr. HILL,
Dr. CROUNE, Mr. OLDENBURG.
Dr. GREW,

It was ordered, that the Society's printer, Mr. MARTYN, be required to give notice in the *Philosophical Transactions* next to be printed, of what the council was

See Philosoph. Transact. vol. xi. n° 128.
P. 668.
This part of Mr. NEWTON's letter was sent to Mr. LEIBNITZ at Paris, 26th June, 1676, to

giver with a MS. of Mr. COLLINS, containing extracts of Mr. JAMES GREGORY. See GREGORY's *Epistola*.

Informant

informed he had declared, viz. that the tract called *Lampas*^a, made by R. Hooke, fellow of the Royal Society, and lately printed by JOHN MARTYN, printer to the said Society, to which is annexed a *postscript*, reflecting on the publisher of the *Transactions*^b, was printed without the leave or knowledge of the council of

^a It was printed in 4to, and intitled *Lampas: or Description of some mechanical Improvements of Lamp and Water-pipe. Together with some other physical and mechanical Discoveries. With a Postscript in reply to Mr. Oldenburg.*

^b The dispute between Mr. Hooke and Mr. Oldenburg began on the following occasion: Mr. Hooke, soon after the restoration, showed the movement of a watch, regulated by a spiral spring applied to the arbor of the balance, and designed for discovering the longitude, to some of his friends, through whose interest in the year 1663 he might have had a patent for the invention; but not liking the conditions, the matter was laid aside. The year following he read several of his Cartesian lectures upon that subject in the reading-school watches to be made. (See his Life by p. 5.) Some account of this invention was afterwards given in the *History of the Royal Society*, (where, without whose assistance Mr. Hooke could not have recovered "several new kinds of pendulum watches for the pocket, wherein the motion is stirred up by springs." This continued the Oldenburg, dated 30th January, 1674. N. S. exact pocket watches, with an invention of his very of which he imparted to Mr. Oldenburg in an epigram, which in a subsequent letter, of 20th in February, N. S. he explained by a full description; on the 18th of that month, O. S. at which time Mr. Hooke said, that divers years before he had such an invention, and that actually watch which he appealed to for the fame; for the Royal Society, to the *Journal Books* of it and to several members. Upon which the Society ordered, that an extract of which the Society were the cause of its want of success, and what after came over from Paris in success. Not long after, for 25 February, 1674. a printed description of Mr. Hooke's invention, with a deluged physical *Transactions*, vol. xi. n. 112. p. 272. This was an offence to Mr. Hooke, who in a *postscript* to his *Description of Helix*, 1675, printed in 1675, com-

plained of Mr. Oldenburg, the publisher of the extract, for omitting to take notice, that "this invention was first found out by an Englishman, and long since published to the world," and he called it *this unhandsome proceedings*. And at the same time he said, that as to the models, which he had yet produced, he was unwilling to add any of the better applications of the springs to them, waiting for an opportunity more to his advantage. Mr. Oldenburg answered to this in the *Philosoph. Transact.* n. 118. p. 440. for October, 1675, that Mr. Hooke had saw and copied the figure of Monsieur Huygens's watch before the extract of the *Journal des Savans* was made. And as he knew that both would be published in one of the *Transactions*, had he given to the editor of them the least intimation, that he desired, that notice might be taken at the same time of his invention of the like kind, it would have certainly been done, as it had been before on other occasions. But Mr. Oldenburg seemed to resent it, that he should be charged with *unhandsome proceedings* on this account, in return he said, that "though Mr. Hooke had some years before caused some watches to be made of this kind, yet without publishing to the world a description of them in print; and it is certain, that none of those watches were *invented*." In reply to this, Mr. Hooke in a *postscript* to his *Lampas*, blamed Mr. Oldenburg for affirming "what he could not know with regard to the *fact* of his watches, whom, as he said, he had not acquainted with his inventions, since he looked on him as one, who made a *trade* of *inventions*." And as to his not having himself published them to the world in print, he said, "they were publicly read of in Sir JOHN CUTLER's lecture, shewn to thousands both English and foreigners, written of to several persons absent, and published in print in the *History of the Royal Society*." Whether Mr. Hooke's watches were *unscientific* or not, Mr. WALLIS says, (Life of Dr. Hooke, p. 7.) that "could not learn, but was inclined to think that expression of Mr. Oldenburg proceeded from passion, the invention and principle of Mr. Hooke's and Monsieur Huygens's being both the very same, as are now said." Mr. Oldenburg took no farther notice of this reply of Mr. Hooke than to publish the following advertisement at the end of the *Transactions* for August and September, 1675. "The publisher of this tract intends to take another opportunity of justifying himself

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of the Royal Society, and that the said printer had seen nothing of the postscript thereof before it was printed off, nor knew any ground for the aspersions contained therein: and in case the said printer should refuse to obey this order, that then the new printer, whom the president hath power to constitute in his room, be required to signify to the public in print, that Mr. MARTYN was removed for disobeying this order of the council.

It was ordered, that Mr. COLWALL and the secretary do prepare for the next meeting of the council a list of those, who had not yet sealed the bond, nor paid their weekly contributions.

October 26. The SOCIETY resumed their weekly meetings.

Dr. GREW made a discourse on the anatomy of some roots of vegetables and thus discoursed of.

The Society was very well pleased with his performance, and declared the discourse and the schemes very well worth the publishing.

Mr. OLDENBURG presented to the Society from Mr. BOYLE his new book, intitled, *Experiments, Notes, &c. about the mechanical Origin of divers particular Qualities: among which is inserted a Discourse of the Imperfection of the Chemists Doctrine of Qualities: together with some Reflections upon the Hypothesis of Alkali*

The president remarked, that having read this book of Mr. BOYLE, he thought it very well worth the reading of philosophical men.

November 2. At a meeting of the COUNCIL were present

The lord viscount Brouncker, President,
Sir JONAS MOORE,
Dr. CROUNE,
Mr. HILL,
Mr. COLWALL,
Dr. HOLDER,
Mr. OLDENBURG.

Upon the debate concerning a scandalous postscript annexed to a book called *Lampas*, it was ordered, that it be referred to Dr. CROUNE and Mr. HILL, to present a draught to the council of what they conceived might be fit for the council to publish in the next *Translation* in behalf of Mr. OLDENBURG's integrity and faithfulness to the Royal Society.

" himself against the aspersions and calumnies of
" an immoral postscript put to a book called *Lampas*,
" published by R. HOOZE, till which time,
" it is hoped, the candid reader will suspend his
" judgment."

Vol. III.

" This discourse on the anatomy of leaves is
" entered in the Register, vol. v. p. 157.
" They are printed in his *Aurum of Plants*.
b. 4. p. 145. & 146.

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At the same time leave was given to Mr. OLDENBURG to print that part of Mons. HUYGENS's letter to him, 20th February, 1674, which devolves on the Royal Society his right of desiring in England a patent for his watches*.

Mr. HENRY HUNT being proposed to succeed in Mr. SHORTGRAVE's place, the council having heard the several good testimonies given him of his abilities and honesty, received him to be operator to the Society, *quamdiu se bene gesserit*; and he was sworn at the same time.

At a meeting of the SOCIETY on the same day,

Mr. OLDENBURG read a letter of Dr. LUCAS HOBSON, a practitioner of physic at Newcastle, dated there, 14th May, 1676, giving an answer to several queries formerly sent to him by Mr. BOYLE concerning the subterranean fire, that had been burning in a coal-mine very many years near Newcastle†: which letter was accompanied with a box, containing some of the *sal armoniac*, as it was gathered there from fire; together with some of the spirit of that *sal armoniac* distilled from quick lime; as also some white salts sublimed from the said natural salt.

Mr. HOOKE mentioned a new fanative spring lately discovered in Staffordshire, healing divers discales, as the dropy, scurvy, &c. adding, that a book was printed concerning it.

It was ordered, that the lord BRERETON should be written to by Mr. OLDENBURG, and desired from the Society to peruse the said book, and give them an account how far the real effects answered the particulars mentioned in it: as also to learn henceforward what kind of persons repair to those waters, and what effects they have upon them.

Mr. OLDENBURG presented from Sir ROBERT SOUTHWELL for the repository a paper of gold sand brought over by him from Portugal, and taken out of a river near Coimbra, having yielded some small grains of good gold.

Mr. OLDENBURG read a paper sent to him from Paris about an odd kind of grain, called by the writer corrupted rye, growing in certain years in several provinces of France, and being so corrupted, that those, who eat of the bread having much of this grain in it, are seized by a gangrene in one part or another, the gangrene not being preceded by any tumour, inflammation, or considerable pain, and the gangrened parts falling off of themselves so as that there is no need to separate them by any remedies or instruments; and it being given to several animals, they died‡.

Some members thought, that it was very well worth making a chemical analysis of this corrupted rye, and to compare it with the like chemical resolution of good rye. Others suggested, that some good rye might

* Mr. OLDENBURG published that part of Mons. HUYGENS's letter in the *Philos. Transact.* vol. x. n.º 159. p. 749.

† This letter is printed, n.º 130. p. 762.

‡ This account is printed in the *Philosop. Transact.* n.º 130. p. 758.

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be planted in the ground, where this corrupted rye uses most to grow, in order to see how that would prove.

November 9. Mr. CHARLES HOWARD produced a parcel of wheat grown of wheat brought from Tangier. 323

He produced also some red-streak and red red-streak apples, grown at Dark- ing, of some of the grafts, which formerly were distributed by the Society; to whom they had been sent by Mr. REED out of Herefordshire.

Dr. GREW read a discourse concerning flowers, accompanied with many elegant and curious schemes in presenting the particulars discoursed of.

He had the applause of the Society, who declared the discourse and figures very well worth publishing.

Mr. BALLE brought in two pieces of amber, sent from Capt. SILAS TAYLOR to the Society for their repository, and said by him to have been taken up in Suffolk at Tangiersford, not far from Harwich.

November 16. Mr. OLDENBURG read a long letter to himself from Mr. JOHN BEAUMONT, junior, of Stony Easton in Somersetshire, dated 17th June, 1676, containing a discourse about rock-plants and their vegetation, together with an account of those various figures, that are found among minerals.

Mr. OLDENBURG read likewise a letter to himself, dated 9th July, 1676, from Mr. LISTER, concerning the black resin formerly communicated by him to the Society, concerning which he intimated the difficulty of finding out a means purely natural, and had never yet come near the fire, that what he had sent was the manner, in which indico is made, except that here the plant is bled, or its veins being cut it is dropped into cold water, and was made much after he said, was this black resin sent by him, without any further process upon it. He added, that it was a totally inflammable resin; and that it would not be brought to dissolve or give its tincture by any means hitherto used by him, which he observed, had not been a few.

Mr. OLDENBURG communicated a third letter to himself from Signor CASSINI, dated at Paris 24th October, 1676, acquainting the Society with some of the astronomical observations made in 1672, by Mons. ROCHER at Cayenne in America, whither he had been sent by the Royal Academy of Sciences at Paris, on purpose to make such observations.

November 20. At a meeting of the COUNCIL were present

* It is inserted in the Register, vol. v. p. 158.
† It is printed in his *History of Plants*, b. 4. p. 183.

* This letter and a former on the same subject dated 7th April, 1676, are printed in the *Philos. Transact.* vol. xi. n^o 129. p. 724. † 1692. T. H.

The lord viscount Brouncker, president,
 Sir PAUL NEILE, Mr. MILLES,
 Dr. CROUNE, Mr. HILL,
 Dr. GREW, Mr. OLDENBURG.
 Mr. COLWALL,

A committee of the council was appointed for auditing the treasurer's accounts, consisting of the president, Dr. CROUNE, Mr. MILLES, Mr. HILL, and Mr. OLDENBURG.

Upon a debate how to proceed with those members of the Society, who had not yet sealed the bond, nor paid their arrears, it was ordered,

That the bond for payment of the weekly contributions to the Society be offered by Mr. WICKS, their clerk, to every member, who had not yet sealed it; and that in case any person should refuse to seal the said bond, his final answer be by the said clerk reported to the council, that so they might know, whether they ought to look upon such person any longer as a member of the said Society, or not.

It was ordered, that Dr. MEIBOMIUS's two books, *de Triremium fabrica*, and *de Proportionibus*, be bought for the library of the Society.

Dr. CROUNE and Mr. HILL brought in their report concerning the *postscript* annexed to the *Lampas*, viz.

"Whereas the publisher of the *Philosophical Transactions* hath made complaint to the council of the Royal Society of some passages in a late book of Mr. HOOKER, intitled *Lampas*, and printed by the printer of the said Society, reflecting on the integrity and faithfulness of the said publisher in his management of the intelligence of the said Society: the council hath thought fit to declare in behalf of the publisher aforesaid, that they knew nothing of the publication of the said book: and further, that the said publisher hath carried himself faithfully and honestly in the management of the intelligence of the Royal Society, and given no just cause for any such reflections."

This report was approved, and ordered to be printed in the *Philosophical Transactions*.

November 23. At a meeting of the COUNCIL were present,

The lord viscount Brouncker, president,
 Mr. COLWALL, Dr. GREW,
 Dr. CROUNE, Mr. OLDENBURG.

* It is printed there, n° 129. p. 749.

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It was ordered, that n° 129 of the *Philosophical Transactions* for the months of October and November, 1676, together with a declaration of this council at their last meeting, ordered to be printed in the next *Transaction*, be printed accordingly.

At a meeting of the Society on the same day,

Mr. JOHN KING, professor of rhetoric in Gresham-College, was proposed candidate by Mr. HILL.

Mr. OLDENBURG read a relation transmitted from Paris concerning a corrupted kind of rye; growing in some parts of France; as also a narrative of some uncommon effects of tempestuous thunder and lightning near Soissons in France*.

He read an extract of a letter from Florence concerning a prodigious fire, that appeared there the 31st of March, 1676, sent to the Abbe de la Roque at Paris together with an account sent to Signor CASSINI of the same phenomenon seen at Rome, Genoa, Bologna, Imola, and other places, the same day, and about the same hour, that it appeared at Florence*.

November 30. Sir RICHARD EDGECOMBE was elected and admitted.

Sir THOMAS CLUTTERBUCK and Mr. KING were elected.

A committee was chosen of the Society for auditing the accounts, which could not be done before, by reason of the president's absence and indisposition, and that no vice-president was present, when this committee should have been chosen. The committee now chosen were Mr. BARRINGTON, Mr. AUBREY, Mr. HAAR, Mr. HOOKER, and Mr. COLLINS.

These went presently apart to examine the said accounts, and both the committee of the council and this committee made their report as follows:

"At a committee of the Royal Society for auditing the treasurer's accounts, November 30, 1676,

"We find the treasurer debtor,

"To monies he hath received on the	Several quarterly payments	l. s. d.
"of the Society, 30th Nov. 1675, to	30th Nov. 1676,	155 1 0
"To money he hath received for admissions	of the priory of Lewes, due	9 0 0
"To one year's rent for the fee-farm of		24 0 0
"at Michaelmas, 1675,		34 17 5
"To the balance of the last account		<u>£ 212 18 5</u>

* This account is printed in the *Journal des Sçavans*, for May, 1774.

* These accounts are printed in the same *Journal*.

"We

" We find him also creditor,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
" By monies he hath paid for the use of the Society, as appears by	192	7	8
" by examination of the vouchers			
" By balance resting in cash in his hands; thirty pounds ten shil-	30	10	9
" lings and nine pence,			
	<u>£ 222</u>	<u>18</u>	<u>5</u>

After this Mr. HENSHAW desired, that notice might be taken, that Mr. HOOKE acknowledged to have received the MS. of St. CYPRIAN which Mr. HENSHAW had formerly borrowed out of the Society's library in Arundel-House; and that the engagement, which he had given for it, being in the hands of Mr. OLDENBURG, might be returned to him.

This being done, the Society proceeded to their anniversary election, and continued the following persons in their council for the year ensuing, viz.

The lord viscount Brouncker,	Mr. Colwall,
The earl marshal,	Mr. Milles,
The lord bishop of Salisbury,	Dr. Croune,
Sir Joseph Williamson,	Mr. Hill,
Sir Jonas Moore,	Mr. Oldenburg.
Mr. Henshaw,	

The new members of the council elected were

The lord Berkley,	Mr. Pepys,
Sir John Lowther,	Mr. Evelyn,
Mr. Aerkine,	Dr. Whistler,
Sir Christopher Wren,	Dr. Mapletoft,
Sir John Hoskyns,	Mr. Creed.

Of this council were elected

The lord viscount Brouncker, president,	
Mr. Colwall, treasurer,	
Mr. Henshaw,	} Secretaries.
Mr. Oldenburg,	

Of the new elected members of the council were sworn Sir John Lowther, Mr. Aerkine, Sir Christopher Wren, Mr. Pepys, Mr. Evelyn, Dr. Whistler, Dr. Mapletoft.

December 7. Mr. Hooke shewed some magnetical experiments*.

* The particulars were omitted to be entered in the Journal.

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1676.] It was ordered, that these experiments be prosecuted; and that the committee formerly appointed to take care of the repository be desired to have a good inclinatory needle made, and suspended in the Society's repository, to see what change there would be in it in tract of time; as also to observe, whether this dipping needle answers the latitude from the pole of the world.

Mr. OLDENBURG read a letter from Signor GREGORIO LETI at Genoa to the Society, accompanied with another from him to Mr. OLDENBURG, dated 8th July, 1676, and with four copies of his book, intitled *Italia Regnante*, in four tomes, the fourth of which was dedicated to the Society. One copy of all the four tomes was now presented bound; the other three copies in quires. Mr. OLDENBURG said, should be produced at the next meeting.

It was ordered, that a letter of thanks to Signor LETI should be drawn up by Mr. OLDENBURG.

December 14. At a meeting of the COUNCIL were present,

The lord viscount Brouncker, president,	Mr. COLWALL,
The lord bishop of Salisbury,	Mr. HILL,
The lord BERKLEY,	Mr. CREED,
Sir JOHN LOWTHEY,	Mr. OLDENBURG.
Sir CHRISTOPHER WREN,	
Sir JOHN FLOCKYNS,	

Mr. OLDENBURG read a letter to himself, dated at Amsterdam, 1st December, 1676, from a merchant named ELIAS SANDRA, Junior, desired to be communicated to the Royal Society, containing an offer made by the said merchant of discovering to the Society such places, where great plenty of ambergrise is to be found; which discovery he would make upon certain conditions and articles accompanying this offer.

The council upon the debate of the whole resolved, that the secretary should return an answer to this offer, viz. that the articles appearing to them to be such, as required personal conferences between the parties contracting for the better understanding of one another's minds, the council would treat with him, if he thought fit to come over: and farther, that they were of opinion, that in case they could agree with him in the rest, they should not differ with him as to his demand third, nor the import of the first and eighth articles, provided first, that, when he had made the discovery, it should not be found a thing already known; and then that the places of finding the proposed plenty of ambergrise be not subject to some jurisdiction or other of either the English or Dutch East India company, or any other, that might justly oppose or hinder the execution of the design.

No 130 of the Philosophical Transactions was ordered to be printed by the Society's printer.

At

At a meeting of the SOCIETY on the same day,

Mr. Hooke, upon account of the presence of Sir JOSEPH WILLIAMSON, one of the principal secretaries of state, repeated his suggestions, made at the last meeting, concerning the dipping needle, viz. that it was very difficult to find what the inclination of the needle should be; and there being no certain way of knowing the needle's inclination, there could be no certainty of knowing the longitude thereby.

He said, that, according as the needles are longer or shorter, they have different inclinations; and that it is not known what distance the dipping needle must have from the magnet for such or such a latitude.

He added, that if we have but the true variations of two places, whose longitudes are exactly known, that will give us the magnetical pole: and then if the variation be true, and the pole given, we need no dipping-needle, because we shall then be able to tell where the needle must dip.

December 21. A motion being made, that the Register and Letter-books of the Society might be reviewed, in order to see what might be fit to be published; it was ordered, that Dr. WHISTLER, Dr. CROUNE, Mr. HILL, Mr. OLDENBURG, and Mr. HOOKE, or any three of them, be a committee for that purpose; and that they acquaint the president with the particulars, which they shall have thus selected.

Dr. GREW read his lecture concerning the essential and marine salts of vegetables, wherein he asserts, that there is no generation of bodies unorganical but what it is in the power of art, by mixing or unmixing, to make or imitate. Several instances whereof were formerly given by him, and the artificial productions in imitation of those of nature viewed and tried before the Society; one of which was a marine or common salt, made out of the lixivial salt of a vegetable; and because this seemed to be doubted of more than the rest by some learned persons then present, he thought it requisite to prosecute the experiment, that, if possible, it might become clear and unquestionable. And because the former method was imperfect, and required a long time (three quarters of a year at least) for the experiment, he said that he had bethought himself of another way, which proved better and much more expeditious, and which wishal afforded him not only a true and perfect marine salt out of the salt of a plant, but also a third kind of salt different from both; which may not be improperly called, the essential salt or nitre of plants. The history or manner of the production he gave an account of in his lecture.

1677, January 4. Mr. OLDENBURG produced a present, sent by a gentleman of Germany, named CHRISTIANUS ADOLPHUS BALDUINUS, to the king, as founder of

¹ It is inserted in the Register, vol. v. p. 178. and printed in his Anatomy of Plants, lecture 4. p. 261.

the Royal Society, and to the Society jointly, viz. a stony substance or paste, which being exposed a little while to the day-light, or flame of a candle, will so imbibe the light, as to shine in the dark like a glowing coal.

There being a letter sent with it, dated 1st September, 1676, it was read and ordered to be registered ^a, and the presenter to be solemnly thanked by a letter to be drawn up by Mr. Oldenburg, who proposed him candidate for election into the Society.

The experiment with this shining stone was tried, and succeeded pretty well, but not so well as was expected, it being almost night, and very dark weather.

January 11. The stone shining in the dark was tried again, and fully answered the import of the letter of the presenter.

It gave occasion of discourse to the Society, whether this substance gained the light by imbibition; or whether the light was caused by a communication of the motion of the sun's or candle's light, &c.

Dr. CROWE mentioned, that Mr. BOYLE having published many experiments, shewing, that divers substances being exposed to the fire increased in weight thereby, it seemed worth while to observe, whether some of those bodies would not so receive light, as to render it in the dark.

There was read part of a letter of Dr. BEAL, dated at Yeovil, 27th December, 1676, giving an account of his thermometrical and baroscopical observations in the last sharp frost; the sum whereof was, that he never saw the liquor in the scaled thermometer descend near so low as it was from December 15 to December 20; and that the barometer stood at a more than ordinary height in the extreme frost; but descended a quarter of an inch a-day before the alteration appeared, and was on the 27th of December at the highest again.

January 18. Dr. Grew entertained the Society with a lecture concerning experiments in consort upon the dissolution of salts in water ^b.

In this discourse he examined and shewed before the Society, that water having been fully impregnated with one kind of salt, so as to bear no more of that kind, it will yet bear or dissolve some portion of another, and so of a third; the doing of which having brought into his mind divers other experiments relating thereto, he delivered them likewise in this discourse: as

1. With what difference this Super-impregnation may be made upon the solution of different salts.

^a It is printed in the Philosoph. Transact. vol. 1. p. 191. p. 243.
^b It is inserted in the Register, vol. v. p. 188.
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and printed in his *Anatomy of Plants*, lecture 7. p. 296.

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2. Whether the solution of a smaller quantity of several salts is not consistent with the ~~non~~ increase of the bulk of the water.
3. What quantity of the several kinds of salt may be dissolved severally in the same quantity of water.
4. Whether by dissolving a salt in water, there be any space gained or not; that is, whether the bulk of the water be greater before the salt lying in it be fully dissolved, than afterwards.
5. Whether the space be equally gained by an equal increase of the same salt.
6. Whether upon dissolution of the several kinds of salts be gained so many several quantities of spaces.
7. What that just space may be, which any salt gains with respect to itself or its own bulk.
8. What that just space may be, which any salt gains with respect to the bulk of the water.

The experiments of all which he explained in the discourse itself.

It was ordered, that the experiment of dissolving several salts, one after another, in water, as common salt, nitre, alums, sal armoniac, should be tried before the Society at their next meeting.

Mr. HENSHAW presented from Sir JOHN CLAYTON a piece of the Bononian stone.

Mr. OLDENBURG read a letter from Dr. MUKALTUS, a physician of Zurich, dated 20th December, 1676, concerning the generation of crystal.

January 25. At a meeting of the COUNCIL were present:

The lord viscount Brouncker, president.

Mr. AERSKINE,

Sir JOHN LOWTHER,

Mr. HENSHAW,

Mr. COLWALL,

Mr. MILLES,

Mr. HILL,

Mr. CREED,

Mr. OLDENBURG.

Mr. HENSHAW was sworn vice-president of the Royal Society.

Mr. OLDENBURG acquainted the council from the earl marshal, that his lordship was desirous, that the library at Arundel House given by him to the Royal Society might be better looked after: as also, that he should be glad to have those books of that library delivered to him, which he had reserved out of it to himself at the time of the donation thereof, viz: books of heraldry and genealogy.

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It was ordered hereupon, that Sir JOHN HOSKYNs, Mr. EVELYN, Mr. HILL, and Mr. OLDENBURG, or any two or more of them, should be a committee to attend the earl marshal, to deliver to his lordship such books as he had referred to himself out of the Arundelian library; as also to secure that library from damage.

It was ordered likewise, that the apothecary's bill for the last sickness of the late Mr. SHORTEAVE*, amounting to about five pounds, be paid by the treasurer, Mr. SHORTEAVE's widow having first delivered up to Mr. HUNT all the instruments, utensils, &c. belonging to the Society, so that satisfaction be given in this matter to the committee appointed for taking care of the repository.

N^o 131 of the *Philosophical Transactions* for January, 1677, was licensed.

Mr. HUNT was ordered to take a copy of the picture of the late Dr. WILKINS, lord bishop of Chester.

It was ordered, that the astronomical instruments belonging to the Society, and being in their repository at Gresham College, be lent to the observatory at Greenwich, for making astronomical observations; and that Mr. FLOOKE's new quadrant be forthwith finished at the charges of the Society.

Mr. OLDENBURG read a letter from Mr. ELIAS SANDRA, junior, merchant at Amsterdam, dated 12d January, 1677, being a return to the answer sent to him from the council upon his first letter, concerning the proposition of discovering great plenty of ambergrise: the substance of which letter being, that he desired to know the thoughts of the council with regard to the rest of the articles referred thereupon by him, the council caused those articles to be read; and ordered thereupon, that as to the articles for secrecy, they could not be kept secret from those, whom the council should make use of in this matter. As to the fifth article, it would be the concern and to follow Mr. SANDRA's directions relating to the place, where the said plenty of ambergrise is to be found. As to the sixth article, the discoverer's third part should be brought free and without any expence to him into England. As to the eighth article, the council would not be tied to secrecy of a general but a particular discovery.

At a meeting of the SOCIETY on the same day,

Mr. OLDENBURG read a letter of Mr. HEVELIUS, dated at Dantzick, 2d January, 1677, N. S.* concerning his late observations of the new stars in *cello* and *proetore cygni*; together with ephemerides of the several phenomena of these stars from the very first time of their appearance.

It was ordered, that Mr. HEVELIUS be desired, in the name of the Society,

* The Society's operator.

the Letter-book, vol. iv.

176. It is printed in the *Philosoph. Transact.* vol. xii. n^o 134. p. 553. for April, 1677.

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to finish his catalogue of the fixed stars, and that an intimation be given to him of the agreement of Mr. FLAMSTEAD's observations concerning the distances of many of those stars with his observations, of which he would, before it was long, see something in print: and farther, that what Mr. Hooke had published against him, was done without any approbation or countenance from the Society.

It was moved, that the making of the inclinatory needle formerly spoken of, should be hastened by Mr. Hooke, in the exactest manner, that could be.

Dr. GREW began to make the experiment, appointed at the last meeting, of impregnating water fully with one kind of salt, so as that it would bear no more of that kind; and then to dissolve some portion of another, and so of a third.

The president suggested, that one sort of salt being mixed with water, in such a quantity, as that no more of it would be dissolved thereby, the glass should be sealed up, and so set by till the next meeting; and then the same water to be impregnated with another kind of salt, and suffered to stand still again another week, and so on.

Mr. OLDENBURG read two letters written by Mr. CHOLMONDELEY, put into his hands by Sir JOHN WERDEN, concerning little crustaceous live animals, found by the said Mr. CHOLMONDELEY himself, both floating upon mercury in a barometer, and at the bottom of the same.

This being looked upon as extraordinary, that such creatures should be bred in mercury, it being supposed, that they were rather bred from the wooden box, wherein the stagnant quicksilver was; it was ordered, that the observer should be desired to try with the same quicksilver in a glass-case turned up, and to see, whether he could then find any such animal in it.

February 1. There was read part of a very long letter of Mr. LEEWENHOECK to Mr. OLDENBURG, dated at Delft, 9th October, 1676, which had not been produced before, because it could not be sooner translated into English out of the Low Dutch language, in which it was written. The contents thereof were a great number of observations made by Mr. LEEWENHOECK with his microscope, concerning certain little animals found by him in vast quantities in common water, snow-water, well-water, and such water, wherein several sorts of spices had stood infused, both whole and pounded.

It was ordered, that the sequel of these observations should be read at the next meeting; and that the author be desired to communicate his method of observing.

There was also read part of a printed paper, intitled, *Neslitta volans & per vices fulgurans*, composed by Dr. KIRCHMAYERUS, professor at Wittenberg in

¹ December 7 and 14. 1676.

² These observations are printed in the Philos. Transact. vol. xii. n^o 133. p. 821. for March, 1677.

Germany;

Germany; and containing a relation of the author of this substance, and of its performances.

It was ordered, that the author of this book should be desired to send a specimen of this substance, for a trial, as Dr. BALDUINUS had done of his shining stone.

February 8. Sir GEORGE CROOKE was elected and admitted.

Dr. BALDUINUS, who had presented the king and Society with the stone shining in the dark, was elected.

Mr. JOHN FLAMSTEAD was elected, Sir JONAS MOORE and Mr. DANIEL COLLWALL affirming, that he had been formerly proposed, though it appeared not upon the Journal, that he had been so.

Dr. GREW read a lecture, beginning the comparative anatomy of animals, of which he had opened eight of the smaller kind, viz. a weasel, a polecat, an urchin, a squirrel, a spaniel-bitch, a rabbit, a fox, and a sheep: of all which he discoursed; and shewed their entrails.

The Society being very well pleased with this design, and this beginning of the execution thereof, exhorted Dr. GREW to pursue this argument with all possible care and expedition and to leave in the repository those parts, which he should from time to time produce upon occasion of his lectures.

Mr. HENSHAW presented to the Society from Sir JOHN CLAYTON a piece of the Bononian stone, which shines, when duly prepared, in the dark; together with Dr. MENTZLIUS's book concerning the method of preparing it.

It was ordered, that Dr. MAPLETOFT and Dr. CROUNE take care of the preparation of this stone, in order to make it shine in the dark.

February 15. The glass of water impregnated with common salt a fortnight before was produced, and the water having left undissolved a considerable quantity of the said salt, it was by order of the Society poured off, and five drachms of nitre put in the same, and so sealed up.

Mr. OLDENBURG produced the sequel of Mr. LEWENHOECK's letter concerning the great plenty of very little animals observed in rain, well, sea, and snow-water; as also in water, in which pepper had lain infused.

The remainder of this paper was referred to another meeting; and the secretary was again desired to procure from Mr. LEWENHOECK his method of observing, that his discourse entered in the Register, vol. v. p. 115. The substance of it is published in his *Curious History of Stomachs and Intestines*; subjoined to his *Microscopical Societatis*, printed at London, 1681, in folio.

by

by making use of the same, the Society might be enabled to confirm his observations.

One Mr. WYNN produced an inclinatory needle, which being tried and found imperfect, the artist was solicited to endeavour to make an exact one; which he promised to do.

An extract of a letter of Dr. WALLIS, dated at Oxford 30th January, 1674, was read, concerning the meteor seen 20th September, 1676, in and near Oxford, and in many other parts of England*.

February 22. Sir JOHN LOWTHER produced the figure of a goose-egg, with another within it, which had been both of them hard, and were laid at Brougham in March 1674. They were said to have been, in every respect, like other eggs, except the size of the outermost, which had been ten inches about breadth-wise, and fourteen inches length-way; and after the yolk and white of the outer egg was poured out at a little hole, the inner egg moved up and down within it.

The third part of Mr. LEEUWENHOEK's observations concerning living creatures in water, in which pepper had been infused, was read.

The glass, wherein at the last meeting was put some nitre, being produced, and the nitre found to be all dissolved, more of the same nitre was put in, to see, whether it would dissolve this likewise.

March 1. Another inclinatory needle was tried, and proved to be better than the former. However, the artist was still pressed to try to make another yet more exact.

Mr. HENSHAW shewed the Society a magnetical experiment, of taking a bar of iron, and holding it perpendicularly to the horizon, and upon applying to the lower end of the iron a needle touched with a loadstone, the south pole of the needle turned to the lower end of the iron; but upon applying the needle to the upper end of the iron, the north pole of the needle turned to that end of the iron, which was so erected, neither pole of the needle would turn to the iron, but the needle turned parallel to the horizon, and stood due north and south. So likewise, if he held the iron, neither pole of the needle would regard the iron, but the needle stood due north and south. But that, which was most strange, was, that to either end of the iron (if it had not been touched with a loadstone) turn it downward or upward as nimbly as you can, the needle will as nimbly turn its north pole, when it is erected, and its south pole, when it is depressed; and either end of the same iron produces the like effect.

* This letter of Dr. WALLIS, and one of the 20th of January, 1674, and another of 8th May,

1677, are printed in the Philosoph. Transact. vol. xii. n° 135. p. 863. & seqq.

This experiment was ordered to be registered, when Mr. HENSHAW should have fully delivered it in writing, which he was desired to do.

March 8. The African company sent by Mr. CRISPE to the Society for a present an uncommon horn, thought to be an elephant's tooth, which was wreathed in an extraordinary manner, affirmed to have been brought by a captain of a ship from the river Gambia.

Dr. GREW read a lecture concerning the proportion of the fixed salts of one plant, or part of a plant, to the fixed salt of another, and to all the other principles in any one plant, as

1. What proportion the fixed salt of the pith, or pithy part of a plant bears to that either of the fibrous or woody part; or whether there be a fixed salt always found in either of them?

2. Whether the bark or the wood of the same tree yields the greatest quantity of fixed salt?

3. Whether the bark of the body or the bark of the root; and so whether the wood of the body, or the wood of the root of the same tree, yields most fixed salt?

4. Whether trees, herbs, and bushes, quantity for quantity, & *ceteris paribus*, yield the most fixed salts?

5. Whether of two plants of the same kindred, one growing in the field, the other on the sea-coast, that near the sea doth not yield a greater quantity of fixed salt?

6. Whether a plant yields more salt, being only dried and then calcined, or being first distilled, and then calcined?

7. What different quantities of salt the tartars of several sorts of wine do yield; as of whites, claret, Rhenish, &c? whence partly the strength and nature of wines may be judged.

8. How far the proportion of salt is different, according to the different tastes of plants? instanced in seven several tastes.

9. How far the proportions of the fixed salts of plants vary according to their faculties; and first, those that are only alterative and opening; next those, that are thoracics, antiscorbutics, antihysterics, stomachics, cephalics, diuretics?

* It is inserted in the Register, vol. v. p. 206. and printed in his *Anatomy of Plants*, lecture 3.
p. 395.

10. How far the proportions of the salts of plants do vary according to their cathartic faculties?

11. How far gums and resins obtain a different proportion of salt, according to their different virtues? as of resin, mastic, olibanum, asa foetida, gum Arabic, euphorbium, myrrh, opium, aloë, gum guaiacum, scammony, and gutta Gamba.

From which he collected, that there is no purging gum without some portion, more or less, of a fixed alkali: so that it seems, that the fixed alkali, as it is combined with the other principles, some way or other, has some interest in the business of purgation. 2. That considering the dose of any purging gum, the quantity of the fixed alkali must needs be extremely small in comparison with the volatile parts of the gum, wherein therefore its purgative power principally consists. 3. That of these volatile parts the purgative force lies neither in the sulphur, nor in the salt alone, but in both, as intimately united one to another, and to their alkali into one body, as appears from the calcination.

March 15. Mr. WYNNE produced two other inclinatory needles, both which stood true, before they were touched, at any degrees, where they were put. And one of them being touched on both ends stood at seventy-three degrees one way and seventy-four and an half the other way, tried several times. The other being touched first at one end only, stood at seventy-two degrees and one fourth one way and seventy-three degrees the other way; but when afterwards it was touched at both ends, it stood at seventy-three degrees and three fourths one way, and seventy-three degrees and one fourth the other way.

Mr. OLDENBURG produced a letter sent to him by an anonymous member of the Society, concerning Mr. HENRY BOND's book, intitled, *Longitude found*; which being read, it was ordered, that Mr. COLWALL should be desired to ask Mr. BOND, how he came to know the difference of longitude between London and Waygatze to be fifty-eight degrees.

Sir ROBERT SOUTHWELL sent for the repository an odd leg of an human body, which he had brought with him out of Ireland; in which leg there seemed to have been an extraordinary ulcer, which had swelled the ancle-bones.

Mr. HILL gave for the repository a cone, said to be the dried fruit of a cedar-tree of Lebanon.

March 22. There was read an account communicated by the earl marshal, of the diamond-mines in the East-Indies, their number, variety, manner of working them, together with the several sizes and prices of diamonds: which account was ordered to be printed in the *Philosophical Transactions*, if leave should be given by his lordship.

^r Printed at London, 1676, in 4to. See Philosoph. Transact. vol. xi. n^o 130. p. 774.

^s It is printed there, vol. xii. n^o 136. p. 507. for June, 1677.

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Mr. OLDENBURG read a letter to himself from Dr. WALLIS, dated at Oxford, 14th March, 1677*, concerning a new musical observation, viz. that whereas it hath long since been observed, that if a viol or lute-string be touched, another string on the same or another instrument not far from it, if an unison to it, or an octave, will at the same time tremble of its own accord; it hath been farther noted, that not the whole of that other string doth thus tremble, but the several parts severally, according as they are unisons to the whole or to the parts of that string: and besides, that the same string being struck in the middle, each part becoming unison to the other will give no clear sound at all, but very confused, &c.

This experiment was in part tried, and found to answer the import of the letter.

1677. March 29. Mr. POVEY produced a model of the sepulchre of our Saviour at Jerusalem, said to have been made upon the place by the Maronites.

It was ordered, that Mr. HENSHAW's account of the magnetical experiment, made before the Society on the 1st of that month of March, be entered into the Register.

Mr. OLDENBURG read a letter written to himself from Mr. GEORGE GARDEN, dated at Aberdeen, 17th February, 1677*, concerning a man in those parts of a dotterel quality, naturally imitating whatever he saw others do, and not being able to forbear such imitation: as also concerning a woman, who had voided a stone of more than five inches about one way, and four inches the other way; together with an offer of sending the stone to the Society: which offer was accepted.

April 5. Mr. OLDENBURG produced a piece of a pig's gut, in which an incision had been made, whilst the pig was alive, by opening its belly, and pulling out the guts, and giving it a cut lengthwise, and then applying Mons. REBEL's vulnerary water, and so putting it in again. Whereupon the pig growing well again, and being fattened for brawn, it was at length killed for that purpose; and this gut being looked after, was found perfectly and strongly healed up again. This gut being sent by his highness prince RUPERT, who had himself caused the said incision to be made, it was ordered, that the humble thanks of the Society should be returned to him, and that it be intimated, that it would be worth while to try, whether such an incision would not heal of itself without the application of any thing.

Mr. BOYLE sent in by Mr. OLDENBURG the proposall of a magnetical experiment, to observe whether the virtue of a loadstone would be diminished or increased by several accidents.

* It is printed in the Philosoph. Transact. vol. III. p. 839. for April, 1677.
* It does not appear there.

* It is printed in the Philosoph. Transact. n° 134. p. 842.

It was ordered, that the apparatus should be made ready for trying the proposed experiment; which apparatus was recommended by Mr. BOYLE himself after this manner:

Apply to the caps of a loadstone a thin smooth plate of steel of small breadth and convenient length; from the midst of which plate should reach downward a little moveable hook, at which a light scale might be so hung, that when it is laden, the centre of gravity of the weight or weights, together with the plate, may hang most conveniently for the sustentation of the whole by the loadstone. Into this scale, by little and little, small weights are to be put in, till the addition of a very little more, as of a grain or two, or less, is able to draw down the plate. Then this plate and the annexed scale being again applied in the convenientest manner to the caps of the loadstone, the whole is to be kept suspended in a very quiet place, to observe, whether the changes of the moon (diurnal or menstrual) the tides, the seasons of the year, the apogee or perigee of the sun, the generation of the solar spots, boisterous and lasting winds, great variations of the atmosphere's weight, conflagration of buildings, &c. will separate the plate from the loadstone, or enable it to sustain a greater weight. The like trials may be made of the dispositive or attractive power of the loadstone, by a needle placed just at such a distance, as may be looked upon to be the utmost in the sphere of the activity of the magnet.

It was mentioned, that Mr. GREATERIX had affirmed of the great loadstone of the lord viscount BALTIMORE, that it would take up less in frost than in warm weather.

It was also remarked, that it would be worth trying, whether a needle being well touched at a loadstone, the stone would thereby lose any thing of its weight.

A letter of Mr. LEEWENHOECK to Mr. OLDENBURG, dated at Delft, 23d March 1677, was read, giving some account of his observing live animals in water^a.

It was ordered, that Dr. GREW should be desired to try what he could observe in the like waters; and that for this purpose an extract should be given him by Mr. OLDENBURG of Mr. LEEWENHOECK's observations formerly read to the Society.

April 12, 19, 26, the SOCIETY did not meet.

May 3. Dr. GREW read a discourse concerning his observations and experiments on the colour of plants: which discourse had three general heads:

1. Of the several colours, as they appear in the plants themselves.

^a It is printed in the Philosoph. Transact. vol. xii. n^o 134. p. 844.

2. Of these colours, as they appear upon infusion

3. Of the colours, as they appear upon the mixture of them, with some other liquors, and particularly into several sorts of liquors.

The sum of what he discours'd of the causes of when the sulphureous and saline principles, though not yet united into one precipitate, no colour results are white or limpid, as usually in the roor, and many vegetable colours, was, that swimming together, yet are from them, but the liquors other parenchymous parts.

When they are mixed, and the alkali is predominant, they produce a green: when the sulphur and the alkali are more equal, they produce a tawny: when the sulphur, acid, and alkali are more equal, then yellow: when the sulphur is predominant, and the acid and alkali equal, then a purple: when the sulphur is predominant to the alkali, and the sulphur both, then the sulphur is predominant to the alkali, and the sulphur both, then they yield a blood red, which is the highest and most sulphureous colour in nature.

This discourse was ordered to be entered into the

My 10. There was read a relation sent by RALPH BATHURST, M. D. dean of Wells, concerning very unusual damps, and their Register-book. in Flintshire, communicated by ROGER MOSTYN, Esq; of the Inner-Temple, who, at Dr. BATHURST's request, had obtained an odd effect in a coal-mine overlee of his coal-work, who was upon the place from his father's steward and Mr. MOSTYN being also assured of it from his face, when the thing happened: of the manor, and from several others, who were Sir ROGER MOSTYN, lord eye-witnesses.

My 17. There were read three letters sent to Mr. OLDENBURG from foreign parts, concerning the late comet, one from Mr. ELICH, dated 1st May, 1677, N. S. the second from Signor CASSINI, dated at Paris, 9th May, 1677. N. S. and the third from Dr. ERICUS MAURICIUS, dated at Spire, 26th April, 1677.

Mr. FLAMSTEAD's letter to Mr. OLDENBURG, dated at Greenwich, 18th May, 1677, containing his observations on that comet, was likewise read.

Mr. OLDENBURG produced a letter to himself from Mr. LEWENHOECK, dated at Delft, 14th May, 1677, concerning the observations made by him of the car- neous fibres of a muscle, and the cortic and medullary part of the brain; as also of moss and cotton.

* It does not appear there: but it is printed in his *Anatomy of Plants*, lecture: p. 269.

† It is printed in the *Philosoph. Transact.* vol. ii. n. 136. p. 895. for June, 1677.

‡ It is printed in the *Philosoph. Transact.* vol. ii. n. 136. p. 895.

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Part

Part of this letter was read, and the rest ordered to be read, as soon as it could be translated into English from the Low Dutch.

MR. OLDENBURG read a letter to himself from Monsr. LEIBNITZ, dated at Hanover, May 4, 1677, giving an account of a substance, which carried its light perpetually within itself, and needed not to be exposed to imbibe light.

There was likewise read a letter of Dr. WALLIS's to Mr. OLDENBURG, dated at Oxford, 8th May, 1677¹, giving a fuller account than his two former letters of 20th and 30th January, of an unusual appearance, September 20, 1676, at Oxford, and in many other parts of England; which the Dr. was inclined to think to be rather a comet, than a meteor, for the reason delivered in this letter.

May 24. There was produced a printed book in French, intitled, *La Duplication du Cube, la Trisection de l'Angle, & l'Inscription reguliere d'un Heptagone dans un cercle: par Messr. COMIERS.*

MR. OLDENBURG mentioned, that he had shewn this book to the president, who having examined it, affirmed, that the author had performed what he had undertaken. Dr. WALLIS being present, was desired to consider it likewise, and to report his sense of it to the Society.

A second letter of Mr. HEVELIUS to Mr. OLDENBURG concerning the late comet, dated at Dantzick, 13th May, 1677, N. S., was read.

MR. OLDENBURG produced Signor CASSINI's printed discourse concerning a new theory of the moon invented by him: which being read, Mr. FLAMSTEAD was desired to take it with him, and to consider it.

MR. OLDENBURG shewed the Society the scheme of an engine called *machina meteo-poetica*, together with an explication of it; which was read, but not thought satisfactory.

May 31. Read Monsr. LEWENHOECK and Dr. WALLIS's account of the duplication of cubes, and of the instant motion of light.

Captain FISSENDEN presented two rarities, a sea fungus corallodes, and the shell of an echinus, matrix of helmet-stones.

June 7. Of a salt of Centaurium minus, which being kindled maketh as great noise as gun-powder.

¹ It is printed in the *Philosoph. Transact.* n^o 135. p. 864.

² Ibid. p. 871.

³ The minutes of this and the two following meetings are from the short ones of Mr. OLDENBURG.

⁴ 200, taken at those meetings, which notes he did not draw out to their due length; for which reason they were not transcribed into the Journal-books of the Society, vol. v.

The same spoke of another salt made of a vegetable, which he names not, which is also a gun-powder, and shoots a bullet with almost the same strength that gun-powder does, and with the same noise.

Of a white loadstone found in a cabinet of a curious person, which hath the same power with the best magnet of the ordinary colour.

Anatomical observation, that the cuticula in some animals hath no pores: that ROLAN and some others affirm, women have none; but they sweat as well as men: but that it is true in dogs and cats, who never sweat, what labour soever they be put to.

Blue bottle beaten with its involucre, and infused in water, communicates to great a virtue to this water, that moderate heat of sand, it not only removes all the inflammations of eyes, but also clears and fortifies and preserves the sight, especially of aged persons: whence the French call it *café-lunette*: put only some drops of it in the eye.

Abroad, studying to recover the way of making that sort of fire, which they called Greek-fire, which increased its force in the water; so called, because the Greeks made use of it, which was about the end of the seventh age. Of which they find it recorded in history, which is newly inserted in the *History of the Crusades*, written by the Jesuit MABOURG, that it was invented by an engineer of Heliopolis in Syria, called CALLINICUS, who made so good use of it in the battle, which the naval army of the emperor CONSTANTINE POLOGNATUS delivered to the Saracens near Cyzicum in the Hellespont, that the Christians burned their whole fleet consisting of thirty thousand men, which were all consumed in the middle of the water, together with their ships. This fire was composed of brimstone, naphtha, pitch, and some gum drawn out of certain trees, and of a bitumen infused in a fountain-water of a peculiar make, and of some other ingredients capable to produce that effect. And this fire had this particular quality, that it fastened so close to people, and to things, that it was not removed by any means, but much stranger, oil itself, which serves for food to wine and sand; and, which is more vigorous, served to extinguish that fire.

To make experiments, whether several needles will mark the same magnetic meridian.

Four needles of several lengths would not vary in shewing the true magnetic meridian. Of 2, 4, 6, 8 inches, two of the same length will mark alike.

The needles with two different loadstones in shewing the true magnetic meridian. Needles not touched, different meridians. Needles

June 21. Horfes gut thirty-seven yards long.

Uses : gullet and its parts, dog more muscular, bones.

Ventricle : all quadrupeds carnivorous small stomach.

Sheep and oxen very large stomach.

Horfe and hare no great stomach, because they much labour and run.

The stomach of carnivorous animals of . . . single.

Granivorous animals have double stomachs.

Method of rumination very fine : the nervous papillæ have a taste and discern.

To discontinue the meeting till a new summons.

September 13. At a meeting of the COUNCIL were present

	Mr. HENSHAW, vice-president, in the chair,
Sir JOHN HOSKYNs,	Mr. COLWALL,
Sir CHRISTOPHER WREN,	Mr. HILL.
Sir JOHN LOWTHER,	

It was resolved, that at the next meeting of the council, the statute now proposed for taking notes by a balloting-box be read, viz.

“ For the more free and private giving of notes at the council of the Royal Society, be it ordered, and it is ordered, that henceforth all votes in passing questions at meetings of the council shall be taken by a balloting box.”

It was ordered, that Mr. BERNARD have two Arabic Psalters out of the Arundel library, giving security, such as Mr. HOOKE shall approve, for returning them within six months, provide the earl marshal consent :

That Mr. BOYLE, Sir JOHN HOSKYNs, and Mr. HILL, or any two of them, do at ten of the clock the next morning go to the widow of Mr. OLDENBURG, Esq; late secretary of the Society, and demand, receive, or take order for securing, for the use of the Society, all such goods, books, and writings belonging to the Society, as were or had been in the possession of her, or of her late husband : and

That Mr. HOOKE agree with Mr. FORSTER for making the catalogue of the Arundel library : and that what he shall agree for, be paid by the treasurer.

September 24. At a meeting of the COUNCIL were present

* The minutes of this day are the heads of Dr. Grew's lecture published in his *Comparative Anatomy of Stomachs and Guts*, p. 12—27.

ROYAL SOCIETY OF LONDON.

Mr. HENSHAW, vice-president,
Sir JOHN HOSKYNs,
Mr. AERSKIN,
Sir JONAS MOORE,

in the chair,
Mr. COLWALL,
Mr. HILL,
Dr. CROUNT.

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This council met by order of Mr. HENSHAW, who in the 21st instant, in the absence of the president, ordered Mr HUNT to summon on a meeting of the council on this day.

Upon reading the case of Mr. OLDENBURG's children and Sir RICHARD LLOYD's opinion thereupon, it was ordered, that MICHAEL WICKS, and HENRY HUNT, be named commissioners on behalf of the Society; and that Mr. HUNT give notice hereto to Mr. BOYLE, and that the persons in possession of the house be desired to keep possession, unless demanded with Mr. BOYLE's consent.

It was ordered, that when any letters concerning the Society be directed to the secretary, what concerns the Society shall be read at the meeting of the Society next after the receipt of such letters:

That all papers and books concerning the Society or library of the said Society: and that if any thing be kept in the repository done there: all that passes at the Society to be transcribed, it be

That the officiating secretary taking short notes of all that passes at the Society or Council, before the rising thereof, read the said notes, in order to see, that they be rightly taken: And,

That the notes so taken be fairly entered by the next meeting day respectively.

The statute for taking votes at the council by ballot propounded at the last meeting was passed as a statute.

The council adjourned till the Thursday following the afternoon.

September 27. At a meeting of the COUNCIL were present

Mr HENSHAW, vice-president,
Sir CHRISTOPHER WAEN,
Sir JOHN HOSKYNs,
Mr. COLWALL,

in the chair,
Mr. HILL,
Dr. WHISTLER,

It was ordered, that Mr. HILL desire Dr. POPE to dispose of his lodgings till the council have notice.

Adjourned till that day fortnight, October 11

! The clerk.

! The operator.

! Inhabited by

the late Mr. OLDENBURG. Officer

October 15, 1677. The Society met again at their usual place in Gresham-College upon summons sent for that purpose by the president.

The president not coming, the vice-president Mr. HENSHAW and the rest of the Society desired, that an experiment might be shewn; which was accordingly done by Mr. Hooke; the effect of which was to shew a very easy but exceedingly curious way to examine the comparative weight of liquors, and that to so great a niceness, as very sensibly and manifestly to exhibit such weight of two liquors, though they differed from one another but a thousandth part of their weight. This was performed by the help of a large glass of a pear-like form, equalling in bulk about three pounds of water, which by that included in it was made almost equiponderant to the water, but yet somewhat heavier, that it might sink to the bottom; but by the finest hair tyed to the stalk could be suspended in the water. This hair was tyed to the scale of a beam, and this poise by a counterpoise in the other scale was made to swim in the water so, as neither to touch the bottom nor the top; and when so poised, it was found, that a fifth part of a grain added to or taken from the scale would make the glass-pear rise to the top or sink to the bottom. Whence it was evident, that the whole glass weighing about four pounds, which amounts to 22040 grains, or 220400 tenth parts of a grain, one single tenth part of a grain would turn it. And the glass, when suspended, being always equal to equal bulk of water, if that might be altered, the poise must be altered; and consequently by help of the scales be made sensible. This experiment and the nicety thereof being understood by the members present, it was desired, that trials might be made at the next meeting upon several sorts of water, as pump water, New River water, Thames water, and rain water, that so they might be experimentally satisfied of the exactness of this new instrument; which was new upon this account, that it had not been taken notice of by any of those, who had written of this subject, such as, GHETALDUS, SEVINUS, PASCAL, &c. they having only taken the comparative weight of some small counterpoise within and out of the same liquor, which they had always performed with the same scales; which are no ways fit for exhibiting the niceness and curiosity of this experiment. Several objections were made and answered, and Dr. WHISTLER explained some things in it, which seemed a little difficult.

This debate being over, it having been concluded in some foregoing • • the vice-president Mr. HENSHAW with the rest of the members desired Mr. Hooke, Mr. OLDENBURG having died since the last recess, to take his place at the table, and to take an account of such considerable matters, as should be shewn or discoursed of at the meetings of the Society; which he accordingly did.

Sir JOHN HOSKYNs, Mr. HENSHAW not being then present, proposed Mr. THOMAS SMITH, chaplain to Sir JOSEPH WILLIAMSON, one of the principal secretaries of state, as a candidate for election into the Society, being seconded by Dr. HOLDER, and others.

¹ The description of this water-poise is published in the Philosoph. Transact. n^o 197. p. 659.

odoriferous substance, yet that could not properly be called a spirit: at least it was not of the nature of a spirit made by fermentation, which was called a vinous or burning spirit. The other odoriferous substance might more properly be called the transpiration or sweat of the plant, very analogous to that of animals, by which they are distinguished one from the other plainly by the smell.

About fining of liquors Sir JOHN HOSKINS affirmed, that thick and muddy cider may be clarified by very fine strainers. Others remarked, that fish-glew or isinglass dissolved with some of the liquor, and then mingled with it, would do the same thing; as also whites of eggs beaten and broken with some of the cider, and then mingled with the whole.

Mr. HOOKE read a letter, which had been delivered him by Mr. HENSHAW, to whom it was sent by the president, in which Mr. LEEUWENHOEK understanding, that Mr. OLDENBURG was dead, desired to know, to whom he might address his letters for the future; inclosing several testimonials of his former experiments, and an account both in Dutch and Latin of some new observations.

The consideration of this was adjourned to the next meeting. And in the mean time Mr. HOOKE was desired to make a microscope after a way, which he proposed as very likely to do as much, if not in the same manner as that of Mr. LEEUWENHOEK.

Mr. HOOKE produced an ephemerides of twelve eclipses of Saturn by the moon, together with the transit of through the sun, and a calculation of eclipses for the two succeeding years; one of which was omitted in HECKER, which was inclosed in a letter to him from of Hamburg; some copies of which he promised to deliver to some astronomical observers.

Mr. HOOKE related, that had affirmed, that by rasping his apples with a bread grater he was able to make almost a third part more of cider than by the common way. He mentioned likewise an expedient of rasping those apples much easier by help of a cylinder covered with tin plates made of the form of a grater. Mr. PACKER objected, that though by that means a third part more of liquor was obtained, yet the quantity of lees after settling would be so great, that little more clear cider would be made that way than by the common.

November 1. Mr. HENSHAW, vice-president, in the chair,

There were produced a great many exceedingly small and thin pipes of glass of various sizes, some ten times as big as the hair of a man's head; others ten times less. These were made, in order to try a conjecture of Mr. HOOKE propounded to the Society, that the discoveries, affirmed to be made by Mr. LEEUWENHOEK, were made by help of viewing with a good microscope such small pipes containing the liquor or water, in which those multitudes of exceedingly small insects or animals wriggling among each other are discovered; for that he alledged, that the said pipes being filled with liquors became themselves as it were magnifying glasses,

glafes, augmenting fuch bodies, as swim in the fluid
aid pipes, which are farthest from the eye-glafs; for
looked on by the help of a very good microscope, for
ous; and they again augmenting the opposite parts
cylindrical surfaces double the effect of a single part
But notwithstanding this there was no discovery
made use of, which was only common pump-water,
It was therefore ordered, that against the next meeting
provided, and some better microscope than that made
Lewenhoeck's assertions might, if possible, be experime
he had produced so many testimonies from such,
eye-witnesses.

After this Mr. LEEVERHOECK's papers, which were read; four of which were a public notary, and other persons of good credit testified to the truth of his former assertions concerning the animals wriggling in pepper-water, some of whom thousand, others thirty thousand, others forty-five single drop of water at big as a millet-seed. The testimonies of some farther observations made by him with his Dutch, and the other the same translated into Latin, estimated the number of two minifers, two thousand, and the other contained animals in a microscop; one written in Latin, the other in English, the particulars of which were of small long sharp pipes; whence he conceived of the blood of young eels, the particulars of which were of eels blood to the eye. 4. Of the eggs and their shapes in the eggs, and their manner of SWAMMER DAM, &c. 5. That he had sent over credible persons, who had attested the truth of his assertions.

After the reading of these papers, Mr. Hooker
city's thanks to Mr. LEWENHUGH, and to
to coverts from him by holding correspondence
son much discourse arose concerning insects bred
firm, that he in May had often taken up with
water great numbers of small insects not visible
which were thereby found to be like a perch,

Sir CHRISTOPHER WREN affirmed, that he standing water a certain small insect consisting before and behind, after the manner of earwigs, the generation of eels, he had near twenty years ago seen them to be viviparous, having seen them alive.

Sir JOHN HOSKYNs produced a bottle of **Y y a** Rinkling sulphureous water, which he had

had received from Dr. CARTER, who had a vessel of it brought from a very strong sulphureous well at Queen's near Bath, in order to the farther examination thereof. For this purpose this, together with a bottle of Willow bridge water formerly brought in by Sir JOHN HOSKYNs, was recommended to the care of Dr. MAPLETOFT, who was desired to put the same in wide vessels well covered to keep off the dust, and in a warm air to be suffered to corrupt and putrify, and then to be evaporated, to see what sediment would be left. This putrefaction was desired, in regard, that, as Mr. HENSHAW affirmed, many liquors without putrefaction will wholly evaporate, which after putrefaction will leave a very great sediment behind; putrefaction, as it were, letting loose or unlocking the parts one from another.

Mr. Hooke produced a piece of leather, which he had made in imitation of the impenetrable leather of the French. This was more supple than the French leather; and it was judged, that the French had more wax in its composition than this now produced; and by the smell the French seemed to be made of some ingredients of a more pleasing smell than this of Mr. Hooke, which smelled more strongly of the boiled salad oil and bees-wax boiled together for an hour or two. This leather, though very limber, was found to hold water for some time without being wet through: but whether it would hold so well as the French, farther trial was to be made; as also of some other composition for soaking the skins in, that they might smell more like those from France.

After this the third experiment was shewn by Mr. Hooke to verify the truth of his former assertions concerning the exceedingly great curiosity of the new contrived poise for examination of the comparative weight of liquors even to the hundred thousandth part of their bulk: and it was before the whole Society evidently shewn, that the eighth part of a grain would manifestly turn that scale, and make it preponderate, in which it was put; and so move a body, that was about four pounds in weight, either upward or downward: Now there being in four pounds weight 176320 eight parts of a grain, it thence follows, that the part of the weight of the water was thereby discovered; which is almost beyond imagination. And it was farther asserted, that this niceness might be as much farther augmented, as should be desired, or was necessary for any manner of curious trials, which was done by making the poise so much larger; and that in such trials, where great quantities of liquors would be troublesome to obtain, it was demonstrated how a receptant-vessel should be contrived, that with some ounces of liquor the examination might be made of a poise of ten, twenty, or more pounds in weight, even to the accurateness of the tenth part of a grain. And to make it evident, that a small alteration of the water would be made sensible by this poise, about the quantity of two grains of salt was put into about two gallons of water; and it was apparent to all the spectators, that the poise grew very remarkably lighter. The same was also repeated; and by a second trial with the like effect the same was verified. Some further trials would have been made; but it being late, the Society rose, and left the farther prosecution of these experiments to some other time.

November

November 8. The Society met at four in the afternoon, the members being absent, Mr. HINSHAW, vice-president, took

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President

The first thing exhibited was the experiment charged last meeting, of examining pepper-water with better small pipes. The fabric of the microscope with better more convenient and expeditious for holding and confining wholly of pieces, which slid any way, and fixed and steady in any posture, and admit light to the comparing of which various ways of enlightening more easily and certainly discern the true shape. But notwithstanding the pepper-mixture was very water and whole black pepper steeped in it for two standing the microscope was much better than that flowing of Mr. LEWENHOCK's animals could be effected with a good deal of reason, that it was very like a proper feafon for their generation; and he was observed to be generated only at certain feafons: are a person, who had seen these animals in Holland the microscope of his own, could not within a fortnight water made here.

[illegible]

He then shewed a way of measuring the big-
the microscope, which was by opening the other
ject with the left eye, whilst the right eye seen
cycle: and it was evident, that a pipe not bigger
cylinder of about three inches diameter: and
some hope of producing at the next meeting
nify much more, and make the parts of the obje-

Mr. Hooke produced a second trial, which rendering it impervious to water. This was a composition of wax and oil of turpentine boiled very limber, and yet very close and impervious put into it, slipping from it like quicksilver adhering to it. And it was conjectured, that effect with that of the French invention. Mr. Cetti, white wax, and pomatum being mixed together might consolidate and toughen the said mixture.

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Upon reading what discourse had passed in the meeting of October 24, about cider and clarifying liquors, several suggestions were added to the former.

Mr. HENSHAW affirmed, that there was a wine made by the juice flowing from the ripe grapes without expression, which was delicious and very clear, and therefore called *l'œil de perdrix*, or the partridge-eye; but that it would not last long, but was for present spending, and presently fit for drinking.

Dr. CROUNE gave a description of *vin de goutte* to be much the same.

Mr. HENSHAW affirmed, that most of those small wines, though they were very pleasant at first, yet were not of any long continuance, few of them outlasting Easter: but that those, which were more harsh and unfit for drinking at first, were the lasting wines. These were made so by the bruising and pressing of the stone, and the steeping in them the husk. That it was this steeping of the husk, that gave the redness to clarets; and that the juice of the grape alone without steeping was white and clear.

Dr. CROUNE suggested, that wines clarified with milk, the lees being thereby precipitated, would not keep; but that vintners draw them off for present spending; as also that vintners in their wines observe to leave in them a flying lee, as they call it, being not perfectly clear, because thereby the wines will drink quicker, and keep better.

Upon mentioning Mr. LEEWENHOECK's observation about the generation of eels and insects, it was related by Sir CHRISTOPHER WREN, that the young eels, which he had formerly taken out of eels, were about the length and bigness of small pins.

Dr. CROUNE affirmed, that he had observed a slow-worm viviparous:

That carps dissected at Swallowfield near Reading in Berkshire were found to be oviparous; but the eggs with perfect young carps.

Sir CHRISTOPHER WREN said, that he had taken out of a lobster's eggs a lobster perfectly shaped with claws, &c. and that water dissected at the proper season of the year have young perfectly formed within them.

Dr. GREW remarked, that silk-worms eggs had the worm within them to be seen through the shell.

Mr. HOOKE affirmed, that he had seen them come out of them alive, and the rest of the shell remaining to stick to the place, where it was first laid.

Mr. HENSHAW observed, that all worms in nuts proceed from without by eating a way into the kernel; which way in a short time closeth up, but leaves behind it a kind of cicatrix. The like was affirmed of the worms in galls, oak-apples,

The first experiment there exhibited was the pepper-water, which had been made with rain-water and a small quantity of common black pepper put whole into it about nine or ten days before. In this Mr. Hooke had all the week discovered great numbers of exceedingly small animals swimming to and fro. They appeared of the bigness of a mite through a glass, that magnified about an hundred thousand times in bulk; and consequently it was judged, that they were near an hundred thousand times less than a mite. Their shape was to appearance like a very small clear bubble of an oval or egg form; and the biggest end of this egg-like bubble moved foremost. They were observed to have all manner of motions to and fro in the water; and by all, who saw them, they were verily believed to be animals; and that there could be no fallacy in the appearance. They were seen by Mr. HENSHAW, Sir CHRISTOPHER WREN, Sir JOHN HOSKYNs, Sir JONAS MOORE, Dr. MAPLETOFT, Mr. HILL, Dr. CROUNE, Dr. GREW, Mr. AUBREY, and divers others; so that there was no longer any doubt of Mr. LEEUWENHOEK's discovery. Notice was ordered to be taken of this discovery, and further trial was desired to be made upon rain-water alone; and upon rain-water, in which had been steeped, wheat, barley, and other seeds and grains: as also that blood and several other liquors should be after the same manner examined. The shape of the microscope and the manner of examining. the . . .

At a meeting of the COUNCIL,

Mr HENSHAW, Mr. JONAS MOORE, Sir JOHN HOSKYNs, Dr. GREW, and Mr. Hooke were named a committee of the council for auditing the treasurer's accounts for the year past.

It was ordered, that Sir JOHN HOSKYNs, Mr. HENSHAW, Mr. BOYLE, Mr. HILL, and Mr. Hooke, or any three of them, be desired to go to the administratrix of Mr. OLDENBURG, and make demand of the books and papers belonging to the Royal Society in her custody, especially those, which were already laid aside and sealed up in a trunk as such: and they were hereby empowered to repay such reasonable charges, as the said administratrix had disbursed on the Society's account; and to give her a discharge for what they should so receive.

November 30. At the anniversary election of the Society,

The eleven members continued of the council were

The lord viscount Brouncker,
The lord bishop of Salisbury,
Mr. Colwall,

Mr. HENSHAW,
Mr. HILL,
Mr. HOSKYNs,

* The entry of the minutes of this meeting in the Journal-book, vol. vi. p. 11. breaks off abruptly here: nor is there any entry of the minutes of any following meetings till that of Dec-

ember 6, 1677.

* The date of which is omitted in the Council-book, vol. i. p. 282.

JONES, on the 11th of September, being admitted into the Society as a fellow, and subscribing the obligation. In the first charter granted to the Society, July 15 h, 1662, and in the second, of April 22d, 1663, Mr. OLDENBURG was appointed one of the two secretaries, Dr. WILKINS being the other; which office the former executed till his death. He began to publish the Philosophical Transactions on Monday the 6th of March, 1667¹, and continued them to the end of June, 1677, without any intermission except for about four months from July 3d to November 6th, in the year 1665, when the Society was dispersed on account of the plague; during which he staid at his house in Pal-mall Westminster, and carried on a correspondence by letters with Mr. BOYLE², whose *History of Cold* he was then translating into Latin³. The same year SPINOSA began a correspondence with him⁴, and several of his letters to Mr. OLDENBURG are printed in his *Opera Posthuma*.

In September 1666 the necessity of his circumstances, and his disappointment in the profit of the sale of the *Philosophical Transactions*, on account both of the late plague and fire of London, made him solicitous of procuring some place for the support of himself and his family; for which reason he applied to Mr. BOYLE, that he in conjunction with the lord viscount BROUNCKER and Sir ROBERT MORAY would recommend him for the post of Latin secretary to the king, if it should become vacant⁵; upon which application the lord viscount BROUNCKER as well as Mr. BOYLE shewed a great deal of zeal for his interest, which he had neglected for the sake of serving the Society, having declined several advantageous offers of travelling with young noblemen abroad⁶.

In 1667, probably in the month of August, he was committed prisoner to the Tower of London; of which he gives the following account in a letter to Mr. BOYLE, dated at London, September 3, 1667⁷, "I was so stifled by the prison-
" air, that as soon as I had my enlargement from the Tower, I widened it, and
" took it from London into the country, to fan myself for some days in the good
" air of Crayford in Kent. Being now returned, and having recovered my sto-
" mach, which I had in a manner quite lost, I intend, if God will, to fall to
" my old trade, if I have any support to follow it. My late misfortune, I fear,
" will much prejudice me, many persons, unacquainted with me, and hearing
" me to be a stranger, being apt to derive a suspicion upon me. Not a few
" came to the Tower merely to inquire after my crime, and to see the warrant,
" in which when they found, that it was for dangerous designs and practices,
" they spread it over London, and made others have no good opinion of me.
" *Incarnata audacter; semper aliquid arberet.* Before I went into the country, I
" waited on my lord ARLINGTON, kissing the rod. I hope I shall live fully to
" satisfy his majesty and all honest Englishmen of my integrity, and of my real
" zeal to spend the remainder of my life in doing faithful service to the nation
" to the very utmost of my abilities. I have learned, during this commitment,

¹ See above, vol. ii. p. 18.

² Boyle's works, vol. v. p. 332 & seq.

³ Ibid. p. 332, 336.

⁴ Ibid. p. 338, and 341, 342.

⁵ Ibid. p. 367.

⁶ Ibid. p. 358.

⁷ Ibid. p. 364.

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Some Considerations left and recommended by H. OLDENBURG to his dear Wife DONO-CATHARINA OLDENBURG: which several pieces are still extant in manuscript. His son was living in 1717, when the council of the Royal Society, on the 28th of March, ordered him a present of ten guineas, in consideration of his father's services to it. The minutes of the council-book of September 13, 1677, mention Mr. OLDENBURG's widow, and those of a subsequent council stile her his administratrix.

FRANCIS GLISSON, M. D. was second son of Mr. WILLIAM GLISSON of Rampton in Dorsetshire, second son of Mr. WALTER GLISSON of the city of Bristol. He was educated in Gonvil and Caius College in the university of Cambridge, where he took the degrees of bachelor of arts, in 1620, and of master, in 1624, and became fellow of his college. October 25, 1627, he was incorporated master of arts in the university of Oxford, and having taken the degree of doctor of physic in 1634, was afterwards appointed regius professor of physic in that of Cambridge, in the room of RALPH WINTERTON, M. D. August 1, 1634, he was admitted candidate of the college of physicians in London, and in September 30, the year following, fellow of it, and in 1639 was chosen lecturer of anatomy in it. During the war between the king and parliament he practised physic at Colchester, where he resided during the siege of that town in 1648, being an inhabitant of the parish of St. Mary at the Walls, but afterwards removed to London. In 1654, he published in London in 8vo. his *Anatomia Hepatis: cui præmittitur quedam ad rem anatomicam universæ spectantia: & ad calcem operis subiunguntur nonnulla de lymphæ ductibus nuper reperta*. This work, which was formed from his lectures read at the College of Physicians, contains a more exact description of the liver and its several vessels, than had been given by any anatomist before: and besides the discovery of the *capsula communis* or *vagina portæ*, and an excellent account of sanguification, acquaints us how by the continual concoction of the blood the bile is necessarily produced and separated from the blood, with the reasons of its bitter taste. In the piece de *Lymphæ ductibus* subjoined, Dr. GLISSON gives an admirable account of them and of the *succus nutritius*, with the manner of its conveyance, and conjectures about the use of the spleen and glands. In 1655, he was chosen one of the elects of the College of Physicians, and afterwards president thereof, in which post he continued several years. He was one of the earliest members of the Royal Society, being proposed February 13, and elected on the 6th of March, 1667. His *Traictatus de Naturæ substantiæ energetica, seu de vivæ vitæ naturæ ejusque, tribus primis facultatibus*, was printed at London, 1672, in 4to. as his *Traictatus de Veniculis & Intestinis: cui præmittitur alius de partibus continetibus in genere, & in specie de ejus abdominis*, was at Amsterdam, 1677, in 4to. He published likewise in conjunction with Dr. GEORGE BATE and Dr. ANASURUS REGE-MORTER, the treatise

^a Wood, Fast. Oxon. vol. i. col. 238, 2d edit. London, 1721.

^b From the Register of the university of Cambridge.

^c From the Register of the college of physicians.

^d The history and antiquities of Colchester by PHILIP MORGANT, M. A. b. 1. p. 63.

^e Ibid. b. 2. p. 4.

^f Dr. GOODAL's epistle dedicatory to his Historical Account of the College of Physicians, &c. edit. London, 1684, in 4to.

de Rachitide sive Miris puerilis, qui vulgo the rickets dicitur: printed at London, 1650, in 8vo. He died in a very advanced age in the parish of St. Brides in London³, October 14, 1677⁴. Several of his original manuscripts are in the library of Sir HANS SLOANE, Bart. now part of the *British Museum*.

FRANCIS VERNON, Esq: was descended from a good family in Worestershire, and born near Charing-Cross in the parish of St. int Martin's in the Fields in the city of Westminster about the year 1637. He was educated at Westminster-School, and thence elected to Christ-Church in Oxford, in 1654⁵, where he took the degree of bachelor of arts, January 28, 1654⁶, and that of master, July 17, 1660⁷. His abilities in Latin poetry are evident from a poem of his intitled *Oxonium Poema*, printed at Oxford in 1667, in 4to. but incorrectly on account of his absence. He was secretary to Mr. RALPH MONTAGU, afterwards duke of Montagu, when the latter was sent, in 1669, ambassador extraordinary to Lewis XIV. of France. During his residence in France Mr. VERNON was very serviceable by his correspondence to the Royal Society, to which he was proposed as a candidate by Mr. OLDENBURG on the 24th of April, 1672, and elected on the 23d of the month following, and admitted on the 12th of June upon his return from France. A strong disposition, which he had very early to travelling, led him to undertake a voyage into the east in 1675; whence he wrote a letter to Mr. OLDENBURG, dated January 10th, 1676, giving a short account of some of his observations in his travels from Venice through Istria, Dalmatia, Greece, and the Archipelago to Smyrna, whence this letter was written, which was soon after published in the *Philosophical Transactions*⁸. In another letter written from Athens to JAMES CRAWFORD, Esq: the English resident at Venice⁹, he mentioned, that he had well examined the ruins of the temple of Delphi and all that was remarkable at Thebes, Corinth, Sparta, Athens, &c. and had clambered up most of the mountains celebrated by the antients¹⁰, as Helicon, Parnassus, &c. that he had spent some time on the banks of the river Alpheus, where he searched with much diligence for the Stadium Olympicum, but could not find any vestiges of it; but that the pleasantness of that river was a sufficient reward for his pains: that Athens had about six thousand inhabitants, and Sparta five thousand; but that at Corinth there was nothing but utter desolation, except the castle, which was of a prodigious bigness, built on a hill above the city, which then scarce deserved the name of a village: that he had particularly observed that place of the isthmus, where a communication between the two seas had been intended to be made: that his fellow-traveller Sir GILES EASTCOURT died on the plains of Solon¹¹, as they went to Lepanto, which place Sir GILES could not reach; for his fever growing more violent with an unquenchable thirst, and he having nothing but water to drink, died on the third day after he fell sick. Mr. VERNON's

³ Wood, *not supra*.

⁴ From a MS. note of Dr. WALTER CHARLETON on the list of the members of the college of physicians in the Pharmacopoeia Londinensis printed at London, 1677, in fol.

⁵ Wood Athen. Oxon. vol. ii. col. 599.

⁶ Id. Fadi Oxon. vol. ii. col. 115.

⁷ Id. *ibid.* col. 128.

⁸ Vol. xi. n^o 124. p. 575. for April 1676.

⁹ Mr. CRAWFORD gave an account of this letter in one to Mr. OLDENBURG, dated at Venice, January 17, 1674, and inserted in the supplement to the Letter-books, vol. ii. p. 427.

journal of his travels is extant among the papers of the Royal Society, being found among those of Dr. Hooke, as appears from a letter of Dr. RICHARD MEADE to the Revd. Mr. EDMUND CHISHULL. This journal, which contains only short and imperfect notes, but a great number of inscriptions, begins at Spalatro, July 8, 1675, and ends at Isfahan, September 14, 1676. The advantage, which Mr. VERNON's travels might have been of to the public, was prevented by an unfortunate death near Ipsahan in Persia in a contest with some Arabs about an English pen knife, which he refusing to give them, they fell upon him and cut him to pieces. His body being conveyed to that city was interred there.

December 6. Sir JOSEPH WILLIAMSON, president, in the chair.

The minutes of November 27, having been read gave occasion of much discourse concerning the hydrostatical experiment, which had been shewn at that meeting, viz. in order to the clearing of some doubts and answering objections, and further experiments after another method had been made at this meeting, if the apparatus, which was ready, had not been accidentally broken at the sitting down of the Society, which was therefore to be prepared anew against the next meeting.

Mr. Hooke then shewed two microscopical experiments, which he had promised at the preceding meeting.

The first was a farther improvement of the compound microscope, whereby he shewed those small insects in pepper-water very much more magnified and more clear than they appeared the day before; which was done by making the object-glass of a much smaller sphere than the last, which was viewed by several of the persons present.

The second was a new sort of single microscope, wherewith he exhibited to the president himself, and afterwards to most of the members present, the same little creatures swimming to and fro in the pepper-water contained in the small canes, and made them so visible, that all, who looked through the said microscope, though they had not been accustomed to the use of glasses, yet discovered them so plainly, as to be able to discover their figures, magnitudes, and motions. And all concluded the appearance this way to be much more clear and distinct, than it was the other way by the double microscope, though that was one of the best of that kind.

Mr. Hooke did now give a description of his single microscope, as having some farther improvements thereof to exhibit in some of the following meetings, undertaking to make the same to magnify objects a thousand times more than this; though this, considering the clearness, magnified about a thousand times more than the common microscopes. He was desired to prosecute these improvements

¹ David Crutched Fryers, July 15, 1709. ² Wood, Athen. Oxon. vol. 600.

with what expedition he could, and to prepare a letter to Mr. LEEWENHÖCK against the next meeting.

Mr. WINDHAM formerly proposed by Sir JOHN HOSKINS was put to the ballot, and chosen without any negative, there being twenty-four fellows present.

Sir PETER COLLETON was proposed candidate by Sir PETER WYCHE : And,

GEORGE WHEELER, Esq; by Mr. CHARLES HOWARD.

Dr. THOMAS GALE, Dr. ROBERT PLOTT, THOMAS SMITH, B.D. being without, were called in, and having severally read and subscribed the engagement in the Charter-book, were by the president admitted fellows.

Dr. GREW read some parts of a discourse, which he had composed concerning flowers ; and shewed the delineation of things taken notice of by him for that purpose.

It was moved, that he would print this discourse ; and Dr. WALLIS mentioned, that it was proper to print all of that kind in quarto, that they might be bound together.

A letter from Paris to Mr. BERNARD, and by him communicated to and translated by Mr. HOOKE, was read, containing several remarkable informations concerning philosophical, mechanical, and other subjects of learning.

Capt. L. ANSFORD's paper about hurricanes presented to the Society by Sir ROBERT SOUTHWELL was read, wherein he gave an account, first of the occasion of his coming to the knowledge of foretelling hurricanes ; which was his kindness to an Indian, whom he had in his power, and who afterwards died in South *. Secondly, of the signs and prognostics of hurricanes, and the great benefit, which he had thereby of preserving ships at sea, and goods at land. Thirdly, his conjectures concerning the reasons and causes of these wonderful and violent storms.

Sir ROBERT SOUTHWELL having desired, that the Society would furnish him with some farther queries pertinent to that purpose, Sir JOHN HOSKINS, Mr. HILL, and Mr. HOOKE, were desired to draw up such as they could think of for that inquiry.

Dr. WALLIS remarked, that in the earthquake, which happened at Oxford in the year 1665, he had observed a very considerable and sudden fall of the baroscope, though he himself did not observe the concurrent accident of the earthquake.

Mr. HOOKE affirmed, that he had for fifteen or sixteen years past constantly

* Letter-book, vol. viii. p. 10.

observed

then, if any considerable jog or shake were given to the tube, in which the quicksilver was suspended, the quicksilver would leave the top of the tube, and fall to the height of thirty inches, or thereabouts, according as the standard of the quicksilver was at that time: and he added, that this second suspension depended upon a second cause, which he had formerly explained in a discourse to the Society.

Mention was made, that Dr. WALLIS had formerly said something on this subject; and it was desired, that inquiry might be made concerning it.

The president inquiring what experiments were designed for the next meeting, Mr. HOOKE undertook to have the hydrostatical experiment ready; as also a farther improvement of the microscope.

It being late, the Society rose, and waited on the president to his own house.

December 13. The president in the chair.

Mr. BARRINGTON and Mr. HALL were sworn of the council.

Dr. GREW was sworn secretary.

Sir PETER COLLETON was elected by the suffrages of twenty-six members without a negative.

JOHN HERBERT, Esq; proposed candidate at the last meeting by Dr. WHISTLER, was elected.

The minutes of the last meeting were read; whereupon a debate arose concerning the cause of the phenomena of the barometer: and whether the same might of the quicksilver always forebush the same constitution of weather.

Dr. HOLDER related, that Dr. VOSSIUS had endeavoured to give a reason of those appearances from the different natures of the air blowing from the sea or from the land; and that the former were light and the latter heavy.

Mr. HOOKE explained the manner how the air at sometimes pressed more, sometimes less; and that was from the real access and accretion of vapours raised up in the form of air; which, whilst intimately mixed with the air, might augment the bulk, as also the specific gravity of the air so long, till by a second sort of vapours all those others become precipitated or condensed into the form of water, whereby the air, out of which they are separated, become lighter in species; and also the altitude of the aerial cylinder becomes lower: for the gravitation of any fluid upon an equal bottom of the containing vessel is always in a proportion compounded of the specific gravity of the fluid itself; and secondly, of the perpendicular altitude of the said gravitating fluids. This he affirmed he had made out formerly to the Society by many experiments, as their Journal-book would shew.

VOL. III.

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To this Sir JONAS MOORE agreed, and explained the same in a tun filled with liquor, wherein the gravitation or pressure against the bottom, or any part thereof, was always equal to the weight of a cylinder, equal to the bottom of that liquor, where it touches the body.

Upon this Dr. WHISTLER made several objections; but upon the farther explication of the manner of making the experiments, he was satisfied with the theory.

Dr. GREGG alledged, that he had formerly proposed a theory of his own, of explaining the pressure of the air by the dissolution of salts, when in his supposition was, that the said salts before dissolution weighed more (that is, augmented the pressure of the air) and after dissolution less (that is, diminished the pressure of the air.) This was not debated, because he promised to bring in his theory, as he had formerly read it in the Society, at the next meeting.

Whilst this was discoursing, Mr. WHEELER was put to the bailor, and elected by the suffrages of thirty members without a negative.

Sir JONAS MOORE related, that Mr. TOWNLEY had made observations of the barometer at Townley in Lancashire for several years, and that the same alterations had happened, which at the same time had been observed at London.

He remarked likewise, that he had himself observed the same at Tangier for a whole year, and had not found the difference of altitude more than one inch all that time in that place; whence the greater constancy of the weather of that place was argued, and that the pressure of the air was not the same in all parts of the earth, but in some places always more, in some always less.

Sir CHRISTOPHER WREN, upon the discoursing of the various pressure of the sea and land-winds, propounded Bermudas as a very convenient place to have trials made of the mutations of the barometer, the seasons there being very temperate, and the island lying encompassed on every side with the sea, and very far from any land.

Mr. HOOKS related, that he had been informed by Sir JONAS MOORE, that observations were then making in another island more conveniently situated for that purpose, viz. in St. Helena, on the other side of the line.

Sir JONAS MOORE confirmed this; and added, that the height of the mercurial cylinder there had not exceeded six inches.

The president thought upon the whole matter, that it was very proper, that observations of this kind should be made in as many parts of the world as could be procured; and that all experiments of this kind wheresoever made, and by whatsoever contrivance, whether by mercury, water, or any other liquor, and whatsoever by a plain or a wheel barometer, or by any other more compounded instrument

ment invented for that purpose, should be reduced to one standard of inches and parts: and that, together with such observations, care should be taken to observe and register the various constitutions and mutations of the air, that happen at those places; viz. the quarter and strength of the wind, the transparency and opacity of the air; as also its present constitution as to heat and cold, dryness and moisture, cloudiness and clearness, and the like; that so from the comparing of these several observations together, a theory might be made of the said mutations grounded upon observations and experience, the sure guides in all inquiries of this nature.

And whereas Mr. Hooke had read in the minutes of the last meeting, that he had contrived a barometer, by which an infinite number of small mutations of the air might be discovered, which would be wholly invisible, and insensible by the more common air-poises, the president advised him, that whatever the contrivance was, he should reduce it to a certain standard of inches and parts, as decimal, centesimal, or thousandth parts of inches.

Upon this it was affirmed, that Sir JONAS MOORE had kept an account for some time of these mutations; as Mr. TOWNLEY had also done for a longer time.

Dr. CROUNE affirmed, that he had also made some observations of this kind, and kept an account thereof.

The like was affirmed by Mr. Hooke.

It was likewise asserted, that Dr. WALLIS, and several other members of the Society had done the like; which observations, it was hoped, would in time be all collected into the registers of the Society as the proper place, where all matters of this kind might be kept upon record.

Mr. OLIVER HILL thought, that it was going very much about to begin with experiments and with theory, and affirmed, that he had, upon what had passed at the last meeting made several animadversions, whereby he had, from a theory, of which he was master, of the nature of the air and of mercury, and from principles of his own invention, plainly shewed the reason of all the experiments, which had been exhibited and discoursed at that meeting, and why things happened so and not otherwise; and that by his said theory, he could not only explain those that there produced, but all others whatsoever of that kind; particularly those about the animals in pepper-water, and the experiments of the water-poises: and that, if the Society thought fit, he would, at the next meeting, bring in and read his said animadversions and theories: which the president desired him to do, although he was acquainted, that the method and business of the Society were very different from those which he propounded; it being their aim rather to be directed by the operations of nature, duly observed, than by theories not built upon a sufficient and unquestionable foundation of observations and experiments.

Mr.

Mr. Hooke then shewed the experiments appointed for this meeting; and the first was an improvement of the single microscope, by which the little animals were exhibited much more magnified and very much plainer, though to some persons they seemed not so plain; the reason of which was to be ascribed to some otherwise imperceptible defects of the eye.

His second experiment was of a water-poise, whereby the difference of the specific gravity of liquors was manifested by the sinking of the neck of a poise into the fluid examined, not at all making use of scales, as in the former experiments. And the niceness and curiosity of this instrument was shewn to proceed from the very great difference between the bulk of the poise under the fluid, and the smallness of the sensible part of the neck, which might be made as one thousand, or ten thousand, or an hundred thousand to one; and consequently that the difference or alteration of the specific gravity of any liquor examined thereby might be discovered, though it were altered but 1,000, or 10,000, or 100,000 part of it.

Dr. CROWE conceived, that the same thing might be discovered by the help of a large beam weighing a great quantity of such a fluid. But it was shewn, that it was wholly impossible to come any thing near that exactness with any such beam, though ever so curiously made, because the great weights, that must be put into the scales of the said balance, would, if the edges of the middle pin of the beam were very sharp, not only flatten them, but sink an impression into the holes thereof; and that whereas half an ounce possibly would be requisite to turn the most exact beam, when charged with two hundred weight at an end, in this half a grain would produce the same effect.

Dr. CROWE also urged, that this was the same with the common water-poise. But Mr. Hooke shewed wherein it differed; namely, that whereas the most exact of that kind, that he had hitherto seen, would not distinguish to a much smaller quantity than about an hundredth part of the bulk, this would do to an hundred thousandth, which was a thousand more exact. And, secondly, that whereas that did it only indeterminately, and without any respect to the specific gravity by uncertain divisions; this was designed to define and determine that also, by giving the proportion, that the said alteration had to the whole.

This was the third instrument of this kind, which had been produced to the Society by Mr. Hooke. And the reason, which he gave of his so doing, was, that it was not his design or intention to load or trouble the Society at their meetings with a confused enumeration of experiments of one kind, which might be made with every one of the said instruments; that being only the work of a labourer or operator to perform, when once the instruments were contrived, and the method chalked out. But his design was rather to improve and increase the distinguishing faculties of the senses, not only in order to reduce these things, which are already sensible to our organs unassisted, to number, weight, and measure, but also in order to the enlarging the limits of their power, so as to be able to do the same things in regions of matter hitherto inaccessible, impenetrable, and unperceptible by the senses unassisted. Because this, as it enlarges the empire of

of the senses, so it besieges and straitens the recesses of nature: and the use of these, well plied, though but by the hands of the common soldier, will in a short time force nature to yield even the most inaccessible fortrefs.

And of this kind were all those instruments, which he had since the last meeting of the Society endeavoured to explain and shew to them. Such were the microscopes, which he had there exhibited, which would as much exceed the common ones, as they did the naked eye; and consequently were an improvement of that sense, which is the most spiritual of all the five. Such were the water-poises newly explained: and such was the barometer, which he was now preparing; for that thereby multitudes of mutations of the pressure of the air, which were wholly imperceptible to the common barometer, would by it be discovered. And to shew, that this was not purely conjectural, he affirmed, that by an instrument of this kind he had discovered such mutations and motions in the atmosphere, as were very surprizing and very significant; such as the tremulous motion of the said barometer before a great storm ensuing, which could in no respect be assigned to any shaking of the house from wind, or the passage of carriages near the place, which was purposely taken notice of.

The experiment propounded by Mr. Hooke for the next meeting was in order to explain the phenomena of the gravitation of the air, and the differences thereof caused by the rising of vapours from the earth; concerning which he affirmed, that he had shewn several experiments, and he supposed, that they were in the Register-books of the Society: but notwithstanding there having been much debate concerning that matter, and several persons there present not being well satisfied concerning the manner, reasons, and signification thereof; it was judged convenient, that it should be prepared by the operator.

December 19. At a meeting of the COUNCIL were present

Sir JOSEPH WILLIAMSON, president,	Dr. KING,
Sir JOHN LOWTHER,	Mr. HENSHAW,
Sir PAUL NEILE,	Mr. HILL,
Sir ROBERT SOUTHWELL,	Mr. HALL,
Sir CHRISTOPHER WREN,	Dr. GRIW,
Sir JONAS MOORE,	Dr. WALTER NEEDHAM,
Sir JOHN HOSKYNs,	Mr. COLWALL,
Mr. CHARLES HOWARD,	Mr. HOOKE.
Dr. HOLDER,	
Dr. WHISTLER,	

It was ordered, that what experiments shall be undertaken by the curators shall be propounded a fortnight before the shewing thereof, that objections, answers, and confirmations may be timely thought of: and

That the curators or any other person shewing an experiment to the Society shall explain the time, and shew the design and usefulness of it.

A de-

A debate about making collections out of the Register and Journal-books, in order to print them, was ordered to be resumed, when the papers and books are recovered by the Society.

Both the secretaries were ordered to be employed in taking the minutes at the meetings; but these minutes to be drawn up fair for the amanuensis to enter, who is also to read them.

It was ordered, that a common letter be drawn up by the secretaries against the next meeting of the council: that all letters to the secretaries be for the future inclosed in a paper to the president, Sir JOSEPH WILLIAMSON, his majesty's principal secretary of state: and

That all letters received be passed into a book, as they are received; and that such of them as shall be thought fit, shall be fairly copied out into the Letter-book for that year.

December 20. Mr. HENSHAW, vice-president, in the chair.

The minutes of the meeting of the 13th instant were read; and the vice-president desired, that the experiment of the small animals in pepper-water might be shewn to the lord HALIFAX*, then present, who plainly discovered them swimming up and down in the liquor.

Mr. OLIVER HILL was called upon for his discourse, which he had promised at the last meeting, upon several matters, that had been shewn to the Society: to which he made an apology, for his not bringing in his thoughts of the baroscope, by reason that he could not obtain what observations had been made by Dr. WALLIS and others, which he had called for of Mr. HOOKS, but they were not in his custody. He made some objections to what was entered as his sense at the last meeting; and said, that though he did maintain, that we ought to be ruled by a theory in the making all our experiments, yet he would be understood to have the theory founded upon previous experiments. Upon such a theory as this he affirmed to have found the cause of the little animals abovementioned; and that was, that the skin of the pepper being very porous, and full of small . . . was the cause of the receiving the spirit of the air, which is there as in matrixes, and by the heat and dryness of pepper hatched into animalcules: that these little creatures were actually alive in the pores of the skin of the black pepper; and that they were by water to be washed off from the surface of them. When it was objected, that it did not seem so probable, that these animals should be in the pores of the skin of the pepper, since it had been observed, that creatures not much unlike had been found in the steeping of oats, wheat, barley, pease, and divers steepings, and even in rain-water itself, he affirmed, that the same principles would make it out for wherever there was a fit matter, the spirit would operate, and produce an animal.

* Sir GEORGE SAVILE.

The

The vice-president alledged, that REDT had found particular animals adherent to particular bodies ; whence it was probable, that these animals, if they had been produced by the pepper, would not have been produced in these other waters, in which oats, wheat, barley, &c. had been steeped : and therefore it was more probable, that these little creatures were originally in the water ; and that the infusion of black pepper had only afforded them a better food, wherein they increased more plentifully ; and that their seeds or eggs were disposed in the water, and not in the pepper.

To this Mr. OLIVER HILL replied, that there was no need of any such thing as a seed or egg, since there was a spirit of nature, which was every where ; and where it found fit matter to work upon, there it produced an animal.

When it was objected, that there had never yet been any certain experiment or observation of the production of an animal, where there might not be shewn very good reason to believe, that there was a seed or egg for its cause : he answered, that he could easily shew an experiment, that would plainly confute that assertion ; which was, that he could take May dew, and put it into a glass, and seal it up hermetically, and then by ordering the glass in such a way, as he well knew, he could in time produce therein an animal six inches long ; which should continue to grow to that bigness, and that the said animal should in longer decay and vanish again.

And when it was enquired of him, whether he could do it with May dew distilled, he said not ; because that was spirit of May dew, and not May dew.

The vice-president observed, that he had formerly had a creature produced in May dew ; but that the glass was neither stopped nor hermetically sealed ; but that it was rather supposed, that it had come in by the mouth of the glass. He added, that May dew might well be supposed to be a body full of the seeds of living creatures, since it was gathered at a proper time of the year, upon wheat and other vegetables ; and since the animal could not be produced, when any operation had been done upon the said dew, that might destroy the seminal principles swimming in it, as Mr. OLIVER HILL had before confessed, that there could be no conclusion drawn from that argument.

When Mr. OLIVER HILL farther urged, that he would shew an experiment, that he could, by washing black pepper with distilled water, wash out the said animals from their cells in the rine of the pepper : it was desired, that he would against the next meeting provide some such pepper and such water, as should be needful, though it was believed, that the effect would in no wise follow such an operation.

After this discourse, Mr. OLIVER HILL read a written discourse of his, about the method, which the Society ought to take in their proceedings, much different from what they then followed.

Mr.

Mr. GEORGE EUST presented the Society with the printed catalogue of the Bodleian library.

Mr. Hooke shewed an hydrostatical experiment mentioned at the last meeting, which was in order to explain how the mutations of the baroscope were occasioned by the different pressure of the air; which pressure was sometimes greater, sometimes less, according as the exhalations or vapours raised up into the same augment the specific gravity of it, and the bulk also or perpendicular altitude thereof. This he made appear by means of a very high body of glass filled with water, into which was let down a standard of pressure made by a bended tube of glass, in which mercury was put; which, as it descended deeper into the water, and consequently the pressure increased, was raised on one leg, and depressed in the other leg thereof. Then a bladder was tied to the end of another glass-cane, and by the breath, after it was sunk down into the water, was blown up; by which the perpendicular was increased, though not the specific gravity; and thereby the pressure upon the tube of the pressing fluid was increased, and consequently the pressure upon the mercury in the standard. The same was verified by a farther trial made with a large bottle of quicksilver close stopped and let down into the body of the said water: and it was alledged by Mr. Hooke, that the same effects would follow from whatever body it were, that was thus put into the fluid, and augmented the bulk thereof, without at all altering the specific gravity of the same.

Dr. CROWE remarked, that the same liquor, by being put into different cylinders, and so different postures, much augmented the pressure of the same quantity of fluid upon the respective bottoms.

But Mr. Hooke observed, that the same quantity of a fluid body, by being put into ever so much different cylinders, the whole pressure of the said fluid upon the whole bottom of the one would be equal to the whole pressure of the other upon the whole bottom of the second; because the gravity of the fluid must be the same in all postures, and the space possessed by the same would also be equal; for as the base of the bigger is to the base of the less, so the perpendicular altitude of the less is to the perpendicular altitude of the bigger.

To this Dr. CROWE could not assent, but alledged, that he would make out the contrary by experiment.

The experiments propounded by Mr. Hooke for the next meeting were the prosecution of the hydrostatical experiment, and a farther improvement of the micrometer.

The Society then adjourned on account of the approaching festival to Thursday January 3.

1677, January 2. At a meeting of the COUNCIL were present

Sir JOSEPH WILLIAMSON, president,

Sir

Sir JOHN LOWTHER,
Sir JOHN HOSKYNs,
Sir PAUL NEILE,
Sir CHRISTOPHER WREN,
Sir ROBERT SOUTHWELL,
Mr. CHARLES HOWARD,

Mr. HENSHAW,
Mr. HILL,
Dr. HOLDER,
Dr. WHISTLER,
Dr. KING.

It was ordered, that the former committee be desired to visit Mr. BOYLE, and to desire his assistance in recovering the books and papers of the Society yet remaining in Mrs. LARDEN's hands^b: and

That care be taken to have the oaths of Dr. PELL and the administratrix made in chancery, that all the papers belonging to the Society had been delivered; and that they knew of none else.

The common letter to be sent to all the correspondents was read, and altered; and somewhat of return for encouragement of the correspondence was ordered to be added.

The correspondents named were, MALPIGHI, HUYGENS, JUSTEL, CARCAVI, SLUSIUS, HENELIUS, P. LANA, BULLIALDUA, STUZOUT, LEIBNITZ, Sir WILLIAM PETTY, Mr. LISTER, and Mr. NEWTON.

It was Ordered, that all letters received by the secretaries should be produced at the next weekly meeting; and if the Society should think fit, be read; and that that the secretaries take the directions of the Society for the speedy answering them, at least so far as to the acknowledging the receipt: and

That Dr. ROBERT PLOT, in consideration of the promise he hath made the Society, in accommodating them with natural curiosities, and accounts of such other particulars, as would be pertinent to their design, which he might meet with in his survey of England, be excused from his weekly payments.

Mr. HENRY HUNT, the operator, was appointed the treasurer's deputy to receive such arrears of the members, as he should receive directions from the treasurer so do from time to time:

It was ordered, that all acts of the council be entered fairly into the council-book;

That there be prepared once a-year a collection of all such matters, as have been handled that year, concerning four, five, or more subjects, which have been well prosecuted, and completed; which may be printed in the name of the Society against the anniversary election-day:

^b Mr. HOOKER, in a letter to Mr. LISTER, 5th January, 1677, (Supplement to Letter-books, vol. iv. p. 369) observes, that all the papers of the Society could not yet be retrieved from Mr. COLLINGWOOD's executrix's custody.

That the Register-books of the Society be perused; and that what shall be thought fit by the council to be published, be drawn out and printed accordingly: and

That lists of the several persons in arrear to the Society, and of their respective arrears, recommended to several of the council, be made and delivered to them as a memorandum of what they had undertaken.

January 3. At a meeting of the SOCIETY,

Mr. HENSHAW, vice-president, in the chair.

Mr. WHEELER was admitted fellow.

The minutes of December 20 were read; which occasioned much discourse concerning the constitution of the air as to its transparency and opacity, gravity and pressure, fogs, mists, rains and wind; concerning which it was debated, whether an opaque, foggy, or misty air were heavier than a clear transparent air; it was concluded, that the transparency or opacity of the air does not at all contribute to the gravity or pressure thereof; though on the other side the extraordinary gravity of it might sometimes be the cause of its opacity. And the reason was alleged, because sometimes, when the pressure of the air hath been greatest, it hath been observed, that the air hath been as transparent and clear as at any other time whatsoever; and at other times, when the air was supposed, that the transparencies and mists have been taken notice of: and that it was the uniformity of the parts of the air, and the opacity from the disformity and incongruity of them. That it was thus explained by Mr. Hooke, that the æther, which incompasses the earth, is the grand or universal menstruum, which dissolved takes up into itself, and suspends all sorts of vapours and exhalations whatsoever; viz. all those bodies in the atmosphere, which make up or constitute that body, which hath a very great springiness in it, and which will not pervade the pores of glass, but can be confined and included by it, much after the same manner as water dissolves salt, sugar, or the like into itself, and keeps it suspended and intimately mixed with it, that so long as the vapours and exhalations remain thus dissolved and perfectly mixed and united with it, they appear perfectly transparent. But when, by the mixture of different sorts of vapours they either unite with them, and leave the æther; or those other being more congruous to the æther unite and coalesce with, and jostle out these, and to make them a distinct body, these vapours or exhalations become as it were opaque; that is, though really they are in *minimis* as transparent as formerly, yet by being disunited with the air, and having a different refraction, they make the air seem opaque and foggy. That these changes are often wrought from transparency to opacity, and from opacity to transparency; and yet the gravitation of the air not at all altered, by reason, that the same bodies remain suspended in the same part of the atmosphere; and consequently their gravitation cannot be at all taken away. And whereas the vice-president objected, that what was alleged was but hypothetical; and that it was not very evident, that

that there was any such thing as an æther, much less was it understood what it was, and what properties it had; or that the air consisted of such parts, as was alledged; Mr. Hooke answered, that by multitudes of experiments he could make it very evident, first, that there was such a body: secondly, what many of the properties of that body were: thirdly, how very considerable and powerful those properties were in producing multitudes of effects ascribed to other causes generally: fourthly, how those properties might be examined and assayed and reduced to a standard, viz to number, weight, and measure; and consequently, that he could make it a subject fit to be farther inquired into by the Society, whose business it is to be directed by the great schoolmasters of reason, experience; and not to be ruled by groundless fancies and conceits.

By these ways he explained the phenomena of the great gravity of the air upon the long blowing of an eastwardly, and the lightness of it upon the blowing of a southwardly wind; the air in the one coming over a vast tract of land, and so taking up into itself great quantities of exhalations, which remain suspended and mixt with it by reason of their congruity; and the other blowing over a great space of sea, which affords a less quantity of parts disposed to make air.

He also farther explained the reason of the ready converting of vapours into water by the cold of the air, those watery parts being more easily precipitated or separated from the air by the want of heat to keep them agitated; as was instanced in the appearing of one's breath in cold weather, and the easy conversion of the wind produced by water heated in an Æolopile into water again by the want of that heat and agitation.

Wherefore the gravity of the air arising only from the quality of those gravitating parts, which were suspended in the form of air, the greater the one is, the greater also must consequently be the other.

Mr. OLIVER HILL then coming in affirmed, that there was no such thing as gravity in the air; but that air was positively light; and that all, who believed otherwise, were mistaken, and in a great error, as he would presently make appear both by reasons and experiments; and to this purpose alledged many things, which he affirmed he had more at large explained and better digested in a discourse, which he had then about him on that subject; and that he had drawn it up on purpose for that meeting; and that he would read it, if the Society thought fit, and continue those his discourses, if they met with entertainment worthy of them.

After which he read his paper, a copy of which he promised to deliver to the secretary, between that and the next meeting, that an account thereof might be taken by the secretary.

At the same time also he delivered in a copy of his discourse, which he had made at the last meeting, about the worms in pepper-water; intitled, *Reflexions on the Transmutations of the Royal Society in their meeting on Thursday, December 6, 1677.*

Sir

Sir JAMES LANGHAM was proposed candidate by Mr. HORNECK :

And Dr. THEODORE KERCKRINOUS by the vice-president at the desire of the president.

Mr. HOOKS acquainted the Society, that he had met with a discourse of optics newly published by Pere CHERUBIN, containing descriptions of several sorts of binocular telescopes and microscopes, and of an instrument of taking the figure of things at a distance by the help of a telescope. He was ordered to procure that book for the Society's library.

The epitome of six papers from Mr. HEVELIUS to the secretary was read. The first marked A, was a letter about several particulars.

The second marked B, contained an account of the occultation of Saturn by the moon, which he would have observed, but that the weather prevented him.

C was concerning the transit of Mercury through the sun.

D a catalogue of the distances and positions of Saturn to the moon.

E a scheme or draught of the same observed through a twelve and twenty foot telescope.

F farther observations of the changes of the star in *Cello Ceti* continued to December 6. 1677. N. S.

Part of a letter of Dr. SWAMMERDAM to Mr. OLDENBURG, dated at Amsterdam, 10th September, 1677, was read, containing an account of a discovery made by him of a sort of Inaith, that are viviparous.

January 10. Sir CHRISTOPHER WREN, vice-president, in the chair.

The minutes of the last meeting were read : upon which a discourse arose concerning the æther, which Mr. HOOKS affirmed to be the menstruum, vehicle, of most fluid part of the air, into which the exhalations or vapours, which compose the atmosphere, are dissolved or taken up, after the same manner as salt, sugar, or any other tinging body, are dissolved or taken up by water or other dissolving liquors.

That the atmosphere or air, that gravitates on the quicksilver in the barometer, is only that part, which was thus dissolved and taken up ; and that the other part or æther readily and freely pervades the parts of glass, whence glass becomes as

* Letter book, vol. viii. p. 12, 15, and 18.

* Ibid. p. 25.

* Ibid. p. 2.

it were a strainer to separate between the æther and the gross parts of air. That according to the quantity of these vapours or exhalations raised up and suspended thus by the æther in the atmosphere, so was the pressure of it upon the mercury in the barometer: that the rarefaction and condensation of these vapours did not at all alter the pressure, provided the same quantity of the said vapours were in both the said conditions the same.

The vice-president doubted, whether there were any such thing as that æther, which Mr. Hooke had hypothetically supposed, and said, that he would gladly see some experiment, that would make it evident, that there is such a body mixed with the air.

To this Mr. Hooke replied, that he could by hundreds of experiments evidence the reality of such a body; and that from these experiments he was able to collect the several properties of that body; and how many and how very considerable effects it produced in bodies. He farther added, that he had a catalogue of such experiments, which he thought he should have occasion shortly to make in order to the elucidating a theory, which he designed to make public hereafter.

The vice-president farther inquired, whether the dryness or moisture of the air did not cause an alteration of the gravitating power upon the earth.

Mr. Hooke, in answer to this, affirmed, that the dryness or moisture of the air contributed not at all to the gravity or levity thereof; but only the greater or less quantity of the vapours held suspended by the æther in that form; and that whether it were in perfect air, or condensed into small globules of water, which yet remained suspended, it was the same thing, provided they remained suspended.

He farther added an explication of what he meant by air said to be lighter or heavier *in specie*, viz. that that air, which had a greater quantity of exhalation in the same extension was the air, that was heavier *in specie*, and that, which had a less quantity, a lighter *in specie*: and that the condensation or rarefaction of the air added not at all, nor took from its gravity, the same quantity of exhalations in the whole cylinder.

The vice-president inquired farther, whether the air could be made heavier *in specie* by any other cause than cold? To which Mr. Hooke answered, that not only forcible condensation, but several fumes, smokes, and vapours, which may be raised up into the air, may produce that effect; but that it is very difficult to make it sensible by the barometer.

January 17. The president in the chair.

* The rest of the minutes of this meeting were omitted in the Journal book, vol. vi. p. 37, 38. where a blank is left, which cannot be supplied, as the original minutes are not extant.

The

The minutes of the last meeting were read; to some parts of which some amendments were desired, viz.

Dr. WALTER NEEDHAM, upon the mention of worms found in the heads and brains of some creatures, added, that those were not found any where in the head, but in the cavities of the os frontis, which in sheep and kine extends under the horns. Dr. GREW affirmed the same from his own observations.

Sir JOHN HOSKINS remarked, that he knew a person, who by looking upon the wheat, whilst in the blade, knew, which would prove smutty, and which not; and it was suggested, that Dr. PLOT had a theory of that accident, by which he knew how to prevent it in the choice of his seed before sowing.

Upon some farther discourses about the barometer Mr. Hooke suggested, that he had already brought in and shewed the Society several of his experiments, in order to elucidate a theory, which he had on that subject; and that he had as yet divers others behind, which he designed, as fast as conveniently he could, to bring in likewise; and when they had been all shewn, to set down the theory of that matter, as he had conceived it.

Mr. OLIVER HILL, affirmed, that the experiment, which upon trial at the last meeting had not succeeded, by reason, as he said, that the air was then moist and foggy, and consequently, according to his notion, had no elasticity, upon his making trial of it since, had succeeded as he expected.

Sir JAMES LANGHAM and Dr. KERCKRINGIUS were elected into the Society.

WALTER CHETWYND, Esq; was proposed candidate by the president:

JOSEPH LANE, Esq; by Mr. HOOKE:

GEORGE ENT, Esq; by FOSTER:

EDMUND DICKENSON, M. D. by Dr. KING: And,

FRANCIS ASTON, Esq; by Dr. BROWN:

Mr. Hooke produced a letter from Mr. LEEWENHOECK, mentioned by him at the last meeting to have been received; part of which being translated from Dutch into English was now read by Mr. Hooke, containing Mr. LEEWENHOECK's thanks to the Society for their so kind acceptance of his last communications, and his compliance with their invitation sent him by Mr. Hooke to communicate such other discoveries, as he should make, viz. a farther account of divers observations made by him with his microscope since his last letter of 2d January, 1676, N. S. which he had sent to the lord viscount Brouncker, concerning the receipt of which he was very solicitous to be informed. He informed the Society

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Society in this last letter of his farther observations on milk, phlegm, &c.^o: and that those pipes formerly mentioned by them were found in his own as well as in eels blood: that the globules of the blood contained six lesser within them: that both the one and the other were extensible into a great length, and would afterward return into a globular form: that the greater were all of equal size; but the globules of milk were all of different magnitude, some smaller, some greater. He mentioned also an experiment of Dr. DE GRAAFF of injecting milk into the veins of a dog, and explained the whiteness of milk by a sort of milky substance made by a gum dissolved in spirit of wine, and precipitated with water, which would be filled with small globular atoms, and look white.

Dr. GREW remarked, that himself had assigned the same cause of the whiteness of vegetable milks in his discourse on the anatomy of trunks.

Mr. LEBENHOECK's letter added, that the globules of phlegm were the same with those of the blood, but tougher and greener, &c.

Part of this letter not being yet translated was referred to the next meeting.

The president presented the Society with a curious horn, commonly called an unicorn's horn, being very intire and in length almost eight feet, wreathed and tapered to a sharp point. It was at the greater end hollow like an elephant's tooth for about seven inches in length. The biggest part of it was about one foot from the hollow end, where it was eight inches about. It had eight wreaths in the length, and was not perfectly strait, but a very little bent, which might be perceived, if it were looked upon end-way. Its substance was pretty white, and of about the same hardness with ivory.

Sir JOHN HOSKYNs mentioned, that there was lately printed a book concerning these kinds of horns; as also it was remarked, that OLAVUS WORMIUS, in his *Museum*, had given a description of one, and of the fish, out of whose snout it grows.

Dr. CROUNE mentioned a relation of Dr. HAMEY, that

Mr. HOOKE mentioned the relation, which he had received from Mr. NEWLAND, of the like accident, which happened to a ship, wherein he was concerned, in its voyage from the Streight's mouth to Alicant, from a sword-fish, of which the Society had received an account formerly.

Mr. HOOKE produced his experiment, in order to explain the pressure of the air upon the mercury in the barometer; which was a large tube of glass about three feet long sealed at one end, and opened at the other. This was filled with water pretty near the top: then a glass made of the form of an inverted syphon,

^a Mr. Hooke's *Lectures and Collections*, part 2. book, vol. vi. p. 41.

^b This minute is imperfect in the Journal.

and

and containing at the bottom a pretty quantity of mercury. This tube being gradually sunk down into the water, it was very obvious, how the pressure of the water upon the mercury in that part of the syphon, which was open to the water, depressed it, and raised the same in the other part, which was open to the air, and excluded the water. And it was plainly shewn, that the cylinder of mercury kept up by the pressure of the water was always about a fourth part of the length of the water-cylinder between the surface of the quicksilver and the top of the water. It was farther explained by him, and shewed, that the air and water in this represented in all circumstances material in this trial than in the common barometer; that the mercury was common in both; for, as it was supposed, that the barometer at the top of the cane admitted the air, and excluded the air, so in this it admitted the air and excluded the water.

He farther shewed how the alteration of the specific gravity of the air alters the pressure, though the cylinder or altitude of the pressing atmosphere were the same: to make which more plain by an experiment, the fresh water, with which the great glass was filled, was poured out, and was filled with a very strong solution of salt, care being first taken to observe the exact comparative height of the mercurial cylinder to the fresh water cylinder: and it now appeared very plain, that the same altitude of salt-water kept up a cylinder of mercury much higher than the fresh water.

Here by the way Mr. Hooke shewed how the pressure of the air decreased, as by ascending a mountain approach is made nearer to the top of the air. And he mentioned, that he had formerly brought in to the Society divers discourses and experiments, by which he had shewn, that the pressure of the air actually decreases in gravity, according as the experiment was made farther from the centre of the earth, after the same manner as the decrease of the pressure of the water was very visible in this instrument. He added, that he was preparing an instrument for some trials to that purpose, which he would shortly shew. These were two other instruments of the like nature with those other, which he had produced since the last recess of the Society: which instruments were not designed to shew one or two single experiments and no more, but to be constant and standing instruments, whereby all the phenomena of gravitation and pressure may be explained by hundreds of experiments.

Farther, when a query was made, why the longer end of the syphon was not sealed up, but remained open; which was otherwise in the barometer, Mr. Hooke explained the same, and shewed, that it was by reason, that the spring of the air, that was included, would vary its pressure upon the rising or falling of the cylinder of mercury, which being left open, the weight of the air did not any more than the other did in the barometer.

Upon this some queries being made concerning the spring of the air, Mr. Hooke explained that theory, and shewed, that, as the pressure of the water in the greater cylinder increased, it raised the mercury in the opposite leg; and as that

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that rose, so the air thus included would be condensed into a less room, and consequently have so much the stronger spring.

Dr. WHISTLER objected, that though the air *was* more condensed, yet he conceived, that the spring of it did not increase proportionably; explaining his supposition by the instance of a fleece of wool, which would only spring so much, and no more.

To which Mr. HOOKE answered, that though that might seem a little to explain what is meant by the springiness of the air, yet it was no way fit to make out all the appearances of the springiness of it: for that, as he had also formerly proved in the Society, the spring of the air is always condensible and rarefiable, which the wood is not: and that the force of the very spring is always proportionate to the condensation of its bulk.

The president hereupon desired, that such an experiment might again be shewn at the next meeting, which Mr. Hooke promised to take care of and contrive accordingly. He promised likewise, at the president's desire, to shew hereafter his theory of springs in general, having several years before shewed it to the king.

Upon this several queries were made, whether the air near the earth were not of very different degrees of specific gravitation; and whether the pressure was not same. To which Mr. Hooke answered, that the parts of the air, as to their expansion, vary very much, according to divers circumstances attending them, viz. pressure, heat, &c. That oftentimes the parts of the air near the earth might be much lighter in *specie* than those at a considerable height above it: that though in the experiments of rarefaction of the air, it were shewed, that the higher parts must always gradually grow lighter and more rarified, that the higher parts it did not always happen so, but that sometime the rarefaction, yet in the atmosphere went *per saltu*, and by very great leaps. As an argument of this he urged the swimming of the clouds in the air; which seem to be upon the smooth surface of some fluid underneath them, all the under sides of them being perfectly defined, smooth, and horizontal; whereas all the upper sides of them are undefined and heaps. Hereupon Mr. Hooke said, that he had an instrument for examining the specific gravity of the air, which was distinct from spring or pressure.

Dr. HOLDER mentioned, that somewhat like this was also to be observed in smoke, which will run along, and spread itself a great way, keeping as it were the same distance from the ground.

Dr. KING instanced, that a gentleman, who was a patient of his, could two or three miles off from London discover when he entered into the smoke of London.

Upon this some discourse arose about the reason, why some chimnies smoke, that

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that is, do not convey the smoke from the fire up the funnel, but suffer it to spread into the room.

Dr. WHITTLER remarked, that there were four ways used for curing chimnies, according to their different causes of smoking:

1. By pipes added to the top, where the funnels being too short was the cause.
2. By a small pipe in the chimney, if the room be too little to supply a constant current of air.
3. By a cover turning like a weathercock, where a free exit of the smoke is desired.
4. By lessning the chimney, and making a chimney within a chimney, when the latter is too big.

Mr. HOOKER gave a reason, why in this experiment the mercury would of itself rise higher in a greater, and lower in a less pipe: and why water would do the quite contrary; which by the experiment then shewn was plainly made appear to be so. He shewed, that this was the same with what he had long before published.

He added, that these and all other experiments, that had been formerly made by the Society for the examination of the nature and properties of the air, though they had been hitherto the opprobrium of the Society from such persons, as thought themselves masters of all knowledge *a priori* and by revelation; and despised all such, as was acquired by experimental inquiry; yet there is no subject in nature more proper for the Society's examination and exercise. For whatever may be said, that the weighing of the air, and the exhausting and condensing it in æther-vessels, and the like, are trivial and impertinent tricks; yet he doubted not to make it evident, that an exact and thorough knowledge of that is of more concern to mankind than all the other physical knowledge in the world. For it is by that we continually subsist, and without it we cannot live one tenth part of an hour. It is from that proceed the causes of infinite diseases; and it affords as many remedies for those distempers. It is that, in which we continually reside: it is the cause *sine qua non* of all vegetables and animals upon the land; and influences even the fish in the sea. Infinite and unspeakable are the uses of it to the husbandman, the merchant, the tradesman, the mechanic, &c. And that age will be deservedly famous, which shall perfect the theory of it.

January 24. The president and vice president being absent, Mr. EVELYN at the earnest desire of the members present took the chair.

The minutes of the last meeting were read, and some amendments were made about

about the relation^k concerning the worms in the cavities of the *os frontis*: upon which occasion Dr. CROUNE added, that he had observed, that the cavities of the *os frontis* and the little cells of the nose having in them a kind of gelly or slime, are often filled with worms in sheep and other cattle; and that he had observed the same thing in a human skull: but he conceived, that these little worms were engendered in the man's head, which he had anatomized after the death of the person, he having found them seven or eight days after that person's death. He was of opinion also, that the tickling of these kinds of worms under the horns of stags, the said cavities extending under them, was the cause of the stags rubbing their horns. He cited QUELTER for the first author of this observation.

Dr. WALTER NEEDHAM added, that the gelly, which countrymen take out of the heads of cattle troubled with the stagers, &c. was cut out of these cavities.

Upon the mention of Dr. Plot's way of preventing smutty corn, it was suggested, that it was in the skill of choosing the seed before sowing, and in nothing else.

Upon the discourse, that was about the instrument proposed at the last meeting for examining the different pressure of the air at different heights above the surface of the earth, Mr. HILL suggested, that it was very desirable, that a list of inquiries and experiments might be made for that purpose.

Dr. CROUNE mentioned, that Mons. PASCAL at Paris had upon making this experiment found, that there was five inches difference in the altitude of the mercurial cylinders in the barometer at the top and bottom of the mountain, on which it was tried; and that one inch of altitude in the mercurial cylinder answered to about a thousand feet of altitude in the atmosphere or air.

Mr. HOOKE remarked, that this proportion of the two cylinders of mercury and air was not at all times alike, by reason that the specific gravity of the air alters from many causes; as does also the specific gravity of the mercury: but that by this instrument, which he was preparing, that inequality would be discovered.

Mr. HOOKE produced two experiments, which he had promised at the last meeting, being those which were mentioned in the first part of Mr. LEWENHOEK's letter; viz. concerning the constituent parts of blood and milk; which were very plainly to be seen by making use of a small piece of looking-glass plate (sifted of the usual sort of the microscope) which was very smooth and clear; and by touching a little of the blood and milk on the top of it, and looking against the flame of a candle. From whence it appeared, that the blood consists of two substances, the one a containing liquor undetermined and undistinguishable as to its

^k In the margin, which is left imperfect in the Journal book.

parts, flowing about and encompassing the other, which consists of an infinite number of exceedingly small parts, which were plainly perceived to be globular: all which parts were very equal as to bigness, and were seen upon the turning of the microscope to move to and fro very swiftly and very freely, they seeming to cross one another very much, and to move confusedly, though all tending the same way.

In milk the like substances were very visible, only with this difference, that whereas the globular parts of the blood were all of very equal magnitude, those of milk were extremely different. These were exceedingly white like little pearls, whereas those of the blood were red.

The latter part of Mr. LEEWENHOEK's letter was then read, wherein he gave an account of his observations shewn on flegm, in which he had discovered the same globules, as in the blood; but that the vesicles, as he conceived, of them had received some kind of corruption and greenness.

He added also his observations of some exceedingly small animals in pepper-water not one thousandth part so thick as an hair, but three or four times as long as thick. These shot very nimbly through the water, and the length of their shoot was about half a hair's breadth. In old pepper-water likewise he had found eels no thicker than the former, and but one hundredth part of the length of an eel in vinegar.

January 31: Mr. HENSHAW, vice-president, in the chair.

Upon reading the minutes of the last meeting the vice-president related, that the smuttness of wheat proceeded from a certain mildew or honey-dew falling upon the standing corn in the night; which, when the sun rises, is dried and fixed upon the wheat, and hinders the growth; whereby the corn becomes withered and corrupted: and that this is the reason is probable from the method of securing corn from smut, by two men taking a rope between them, and walking along the furrows on each side the corn, and carrying the rope stiff and strained, so as to brush off the mildew from the ears and blades of the corn. An account of this was given by Sir JAMES LONG, as likewise by Sir HUGH PLATT in his book.

Some of the members were of opinion, that mildew is an exudation from a plant, and not a moisture precipitated out of the air, by reason that it was found more upon some plants than upon others; and that it seemed to participate somewhat of the nature of the plant: that mildew and honey-dew are the same: that the true name is mildew or honey-dew: and that it falls or is found sticking much upon the ash.

Sir JOHN LAURENCE mentioned, that he had observed, that the trees about Tunbridge afforded such a kind of sweet dew; and that if it drops upon any thing, it was of such a nature, as that it left a stain behind not to be gotten out.

Dr. MAPLETOFT conceived, that manna is nothing else but such a dew gathered from the leaves of the *fraxinus* and *ornus* chiefly; and he affirmed, that JOHANNES NARDIUS was of the same opinion in his book¹; as also Mr. RAY and JOHN BAUHIN.

Dr. MAPLETOFT remarked, that Dr. THOMAS CORNELIUS in Mr. RAY's catalogue² gives an account of the way of gathering manna.

Mr. HENSHAW mentioned, that the extract made by the bees from plants and flowers was nothing but this *mel* or honey-dew, which he conceived to be partly a dew and partly an exudation: that the bee with its long tongue licks up this substance, and fills with it a place within its body: but that what is more properly the gum of the plant, is the wax, which the bee disposes upon its thighs on the outside.

Mr. HOOKE then exhibited the experiments of the last meeting, to shew the great fluidity of one part of the blood and milk above the other; whereby it plainly appeared by the very free, swift, and confused motion of those exceedingly small globules through the body of the liquor, in which they swim, that it must be very fluid and yielding.

Mr. HOOKE produced and read a letter sent to him from Mr. JAMES YOUNG of Plymouth, containing an account of an accident, which happened to one Mr. ANTHONY WILLIAMSON of L^{...} in Cornwall upon swallowing bullets, one of which slipped aside, and went down his wind-pipe, and produced very sad and fatal symptoms, which ended with his life. This letter mentioned what Mr. YOUNG had observed in the body upon opening it after death; and that he had found the bullet in the left branch of the trachea, where it lay without being altered in its figure, or having made any impression on the trachea, though the lungs were corrupted beyond it.

Sir CHRISTOPHER WREN mentioned, that a relation of the lord WENMAN, upon swallowing a bullet down into his lungs, had been freed from the same not long after by a person, who turned him with his heels upwards, and shook him, and thereby making him cough occasioned the bullet to fall back into his epiglottis, and from thence by the cough to be thrown out with great violence, and so he had no farther mischief thereby.

Mr. HILL related, that . . .

Dr. related, that Dr. MILLINGTON had tried the same.

Dr. ALLEN added . . .

¹ *Disquisitiones physicae de rebus*, printed at Florence in 1642.

² *Catalogus Plantarum Angliæ*, p. 118. edit. Londini, 1670.

* This minute is left thus imperfect in the Journal-book, vol. vi. p. 48.
* This minute is left likewise imperfect.

Mr.

Mr. COLDWALL presented for the repository two glasses, one containing a large locust, a cricket, a very large spider, &c. the other containing a flying fish, two or three very small fishes, and some other small fishes.

A letter was read directed to the Society from Mr. EDWARD SMITH dated from his house without the south gate of Chichester, 22 January, 1677, containing a discourse about the explication of the table of HERMES, and the grounds of his philosophy. It being late, the discourse itself could not be read; but Mr. OLIVER HILL was desired to peruse it, and to communicate his thoughts concerning it at the next meeting; which he promised to do.

Mr. CHETWYND, Dr. DICKENSON, and Mr. LANE were elected.

Mr. HOOKE produced a book of *Jean Jordan*, intitled *Deux Machines jusques ici inconnues*, &c. printed at Leyden in 1677, sent by one MAGNUS HESSENT-SALERUS, directed to Mr. OLDENBURG. This book having been perused by Mr. HOOKE, was found not to contain any description of the instruments, but to relate only what the machines would perform, which was thought impracticable, if not impossible.

Mr. HOOKE produced likewise a book published by MATTHEW CAMPANI, intitled *Horelogium sive Naturæ Motu Temporis momenta motus, & Circulus sphericus Lentibus pellendis*, &c. of which he gave the following account: that this writer, who was rector of a parochial church, and seemed from some passages in his book to be brother to that CAMPANI, who made glasses in Rome, endeavoured to make himself the author of two inventions, which had been long before published and shewn to the Society by one of their own members. The first, of two pendulums rectifying one another was shewn by Mr. HOOKE, 2 January, 1667, as appeared from the Journal, and from the testimony of many, who could not have forgotten it. The second, called by CAMPANI *circulus sphericus*, for making of glasses, was the same with that published by Mr. HOOKE in his *Micrographia*, in 1664; who did not doubt but that this pretended inventor was aware of it, since otherwise he would not have endeavoured to antedate it so much as he had by making it prior to the 6th of October, 1664, citing a letter of Monsr. HUYGENS for his voucher, though the words quoted by him assert no such thing. But upon a perusal of the book it was plain, that CAMPANI could be the author of neither of the inventions, since he seemed not to understand either mathematics or mechanics very impossibly, that he was the inventor of either. Nor did he at all explain how either of the inventions may be performed either mathematically or mechanically, as any one upon perusal would easily find.

February 7. Mr. HENSHAW, vice-president, in the chair.

Upon reading of the minutes of the last meeting concerning mildews, Mr.

* See above, vol. ii. p. 137.

HENSHAW related, that his gardiner had shewed him a substance, which fell upon his hat from the clear sky in an evening in the month of December: that upon examining it, he had found it tasteless and of a substance like the white of an egg; and that therefore it seemed probable, that many of those dews and glutinous substances, which were taken upon the leaves of plants, were dropt upon them out of the air. Others were of opinion, that they might proceed from the exudation, transpiration, or sweating of the plant. To this purpose Mr. Hooke mentioned the great transpiration, that is observable in all plants, and particularly in such, as have been nourished by water kept in glasses: for whoever shall examine the consumption of the water, in which a plant is nourished, and compare it with the same quantity of water kept in a glass by it, and shall also compare the weight of the plant to observe its increase, will find, that a very great quantity of the same is eaten up as it were by the plant; and the greatest part of that is again cast out by transpiration. And possibly from some unnatural or unseasonable blast of wind, the natural transpiration being stoppt, that water might thicken into a kind of sweat, which sticking on the surface produced the milckew.

Upon the mention of the microscopical experiments Dr. KING related, that he had with his microscope examined several substances, to see, whether he could discover those differences of parts, which had been found in blood and milk: but he affirmed, that he could not observe any such in clarets or red wines or in any other wines. But that he had observed in an infusion of wheat bran in common water, and also in an infusion of ginger, a great multitude of those exceedingly small animals; and in this latter a particular sort of very small cells moving much like those of vinegar.

He remarked likewise, that he had examined the serum of blood and rain-water, but could not discover any animals in either of them.

It was desired, that it should be tried, whether white pepper steeped in water would produce any such small creatures.

Mr. Hooke mentioned, that he had found great quantities of those worms in rain-water; and that he supposed them to be generated therein from small invisible creatures flying up and down in the air, after the same manner as other sorts of insects in the summer-time had been observed by Mr. HENSHAW to be bred in rain-water from goats, and to be converted into them again at last: that he had observed them also in river-water and well-water, though not so plentifully: that though the pepper-water, in which these animals were swimming, were frozen into a lump of ice; yet letting it alone to thaw of itself he had found it again very full of those living worms, as if the frost had not done them any harm at all: that he had found also a sort of flat animals, which would contract and dilate their bodies somewhat like a leech; and that their motion in the water was different from that of any other creatures, which he had ever seen in the water, viz. a motion of writhing their bodies in the same manner as a board does, when it is

said to be out of winding; and that thereby they guide themselves, and through the water with great swiftness.

shoot

Dr. MAYOW^a was proposed candidate by Mr. HOOKE.

Mr. HOOKE shewed an experiment to prove the strength of the expansion of the air to be in proportion to the quantity of the air contained in the same space; so that half the quantity had half the strength, and double the quantity double the strength. This was shewed by a glass-cane sunk down into another almost to the top with quicksilver. The first was open at both ends, but the other hermetically sealed at the bottom. In the first was left about three inches of its length filled with air, and the top of it was stopped with soft wax, so that no air might enter in or go out through. Then this cane was lifted up to so far as till the air was expanded into twice its dimensions, and the quicksilver under it was observed to rise only to half the height of the standard. When by lifting it higher, it had acquired four times its first dimensions, the cylinder under it was found to rise but three fourths of the standard; which plainly evidenced one part of the former theory, viz. that the force of the spring of the air was diminished in proportion to the expansion; and that half the quantity had but half the strength.

The other part of it was designed to be exhibited by another apparatus, which was made ready for this trial; but upon examination it was found, that a little part of the top of the glass for that trial was flown off; and therefore the experiment was deferred till the next meeting.

Upon discoursing of the height of the mercurial standard, Sir CHRISTOPHER WREN propounded, that the measure thereof might be reduced to the universal standard, viz. the length of a pendulum moving a second of time, which was between thirty-nine and forty inches long; and which was the same all over the world, and would ever be so in all ages.

Mr. OLIVER HILL being called upon for his report of the discourse of Mr. SMITH of Chichester, which had been delivered to him at the last meeting to be perused, returned this account, which remained annexed to that discourse,

Dignus, dignissimus, qui nunquam imprimator; sed Monsieur Harpocrati asserendus mandatur, ne ullius manibus conteratur libellus.

February 14. Sir JONAS MOORE, vice-president, in the chair.

The minutes of the last meeting were read, and some parts discoursed of: after which

An experiment to prove the force of the compressed air was shewn by Mr.

^a Probably JOHN MAYOW, M. D.

HOOKE,

HOKE, by which it evidently appeared, that the force necessary to condense the air was always proportionate to the condensation. Which was verified by several trials of several degrees of condensation; that is, to condense the air twice, required twice the strength, and thrice, three times the strength, &c. that is, if the same quantity be condensed, then the force or weight of the power, that makes the condensation, shall always be reciprocal to the dimension: but if the dimension be the same, then the force shall be always proportional to the quantity of air contained in that space. This was experimented in a tube of glass about ten feet long; the one end of which was sealed up hermetically, and turned or bent back again in the form of a syphon reversed; in which reversed part there being left ten inches of air, quicksilver was poured into the other part, till the weight thereof had condensed the same into five inches space; the height of which cylinder of quicksilver was found to be about thirty inches. Then the pouring in of quicksilver was continued till the same air was condensed into two inches and a half, and the height of the cylindrical mercury was found to be ninety inches. And the same proportions were observed to be in other compressions.

Sir JONAS MOORE presented the foot of a sea-fowl for the repository.

He gave likewise a large hornet's nest brought from the West Indies, which was several large combs fastened upon the twig of a bough and very thick covered with a sort of leaves or rather cloth of the make of the hornets: which being looked upon with glasses was found to be made up of abundance of small threads, and appeared much like the texture of paper. With these the whole structure of combs was closely wrapped on every side, as if designed to shelter and inclose the nest of the young from the injuries of the air and weather, being a kind of natural hive.

The vice-president mentioned, that he had a letter from Mr. HALLEY from Saint Helena mentioning his observation of the last visible conjunction of the sun and Mercury.

February 21. Sir JOHN HENSHAW, vice-president, in the chair.

The minutes of the last meeting were read; and by the way, upon the mention of the hornet's nest, Sir JOHN HOSKYNs remarked, that Mr. WHEELER had seen the way of bee-hives.

Mr. GEORGE ENT presented to the Society for their library the new *Pharmacopæia Londinensis*, reprinted and amended by the care of his father Sir GEORGE ENT.

Mr. HOKE produced an instrument to examine and shew at all times the specific gravity of the air, in which it is placed, without any respect to the heat or cold, pressure or spring of the air: but the said property of the air was not shewed singly by any other instrument; nor was it proper or capable to shew any other

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other quality of the air, as some had thought, except only the specific gravity of the air. This instrument was first proposed by Mr. Hooke to the Society as appears from the Register-book: but the experiment and instrument itself was not before this time exhibited at the meetings of the Society.

This instrument made to demonstrate the said property of the air was a large and thin ball of glass sealed up hermetically. It was suspended at the end of an exact beam (which would easily turn either one way or the other) and was counterpoised by a small weight of lead or brass; but lead was best for that purpose. Then Mr. Hooke explained the same, and shewed the reason, why the ball would rise when the air, in which it hung, was heavier, and sink when it was lighter; and that it depended upon the same ground with the improvement of ARCHIMEDES's experiment by GHETALDUS.

He also explained the difference between the pressure and the specific gravity of the air. Whereupon Sir JOHN HOSKINS added, that this was properly the barometer, and not the instrument so called.

Sir JOHN LOWTHER demanding, whether this instrument now produced was exact enough to make the small mutations in the air visible, Mr. Hooke answered, that he did not exhibit this for any other use than to shew the ground and a reason of the thing, and as a sensible object, upon which to reason and discourse, and for the more plain demonstration and explanation of all material doubts, that might arise; because without such a pattern or model of the thing designed, the propounder of such experiment or invention is for the most part not so readily understood, and very often mistaken or misapprehended by the auditors: nor can objections be pertinently made where the like model is wanting, especially in all mechanical subjects.

Dr. WHISTLER objected, that this model itself was not satisfactory, but that experiment ought to be made with such an instrument, as both the ball and counterpoise might be immersed in the water; and when so immersed, salt might be added to make the specific gravity of the water greater: that then it might appear, which would sink, whether the ball, or the counterpoise, to which it was annexed.

Sir JOHN LOWTHER answered, that the matter was the same, and appeared as plain, whilst the bells hung in the air, as if they were suspended in water; for as the weight of any body suspended in water was always made so much lighter as the weight of a quantity of water equal to it in bulk weighed, and consequently the heavier the water, the more it would take off from the weight of the ball, the same thing must necessarily follow in air.

However, because in the experiment of weighing, that had been made, both the ball and the counterpoise had not hung in the same medium, it was desired, that an experiment should be shewn to verify that assertion, which Mr. Hooke promised to give order for against the next meeting.

Mr.

Mr. Hooke then shewed the *Journal des Savans* in which was contained the observation of Mercury in the sun made by Monf. GALLET at Avignon³⁸⁷, the manner of which he in short explained to be very ingenious, proper, and accurate; and that seemed not to be defective in any material circumstance necessary to be taken notice of in the observation: that Monf. GALLET had remarked several immersions of Mercury, taking the declinations and right ascensions of it in every one of those places by a method very exact; and that thence he had deduced by trigonometrical calculation the longitude and latitude of Mercury in those several places, and the inclination of the orb and the true time of the conjunction: that he had taken notice, that the body of Mercury was oval, whose longest diameter was parallel to the equinoctial; and that at the emergence of it out of the eastern side of the sun it seemed to spread itself as it were upon the limb of that sun, appearing four times as big in diameter.

Mr. Hooke acquainted the Society with the contents of a letter of Mr. HALLEY from Saint Helena directed to Sir JONAS MOORE giving an account of the same observation made by him in that island: but the letter was restored to Sir JONAS MOORE.

From either of these observations singly the theory of Mercury would be very much rectified, and from the comparing of them both together the parallax and distance both of the sun and Mercury would be experimentally verified.

Dr. ALLEN presented to the Society for their repository a natural bee-hive from Virginia fastened upon the twig of a tree, and very thick inwrapped round with such teguments, as are usual about a hornet's nest, which it very much resembled.

Mr. Hooke promised, beside the experiment of weighing air, to have ready some microscopical observation.

February 28. Mr. HENSAW, vice-president, in the chair.

The minutes of the last meeting were read by Mr. Hooke.

In prosecution of what was desired at the last meeting Mr. Hooke shewed an experiment to elucidate farther the theory of the air-poise produced at the preceding meeting, viz. to prove, that a large and very light ball of glass ordered, as it was at the last meeting, would, upon change of the specific gravity of the fluid; in which it was suspended, rise and fall with such a motion, as would make such alterations visible. In order to which, because such alterations were difficult to make in the air, and because the last instrument was only designed to shew the gross mutations, and not the minuter ones, he having, as he affirmed, another way different from what was exhibited for producing that effect, which would be somewhat more chargeable to produce; therefore a glass sealed up as in the

³⁸⁷ On the 7th of November, 1677, N. S. See *Journal des Savans de Lundy*. 20 December, 1677.

former experiment was suspended at the end of a beam, and so ordered, that a counterpoise to it, when both under the water, was hung into a vessel of fair water, which was taken notice of. Then into that water was put a small quantity of salt, that so by the dissolution thereof the water might be made in *specie*, and thereby the bigger body, which was the sealed glass, ought to be made lighter than its counterpoise, every new fluid taking off so much more or less of the weight of the body contained in it, than was taken off by a former fluid, as a quantity of it equal in bulk to the said contained body weighs heavier or lighter than the like quantity of fluid, in which it was last suspended. Whereupon it was immediately very manifestly verified; for the glass-ball immediately upon the putting in of the salt grew very sensibly lighter, and the counterpoise preponderated; whereby all the objections and scruples, that were made concerning the former theory, were removed. And when inquiry was made, whether it could not be ordered so, as to make the minute variations more sensible, Mr. Hooke affirmed, that he had a way, by which he could make them as sensible, as should be desired; and that instead of varying an inch, he could make it vary ten, twelve, or more feet: The only inconvenience of which instrument was dunt, because that settling upon the surface of the glass would augment the weight thereof: but for prevention of this, he said, that a glass cover and case might be so ordered, as to prevent all those inconveniences, and yet not at all hinder the air within from being sensible and compatible with the air without in the room, in which it was placed.

Mr. Hooke then produced an animadversion of Signor CASSINI upon the observation of Mons. GALLET of the passage of Mercury under the sun; wherein he compared that observation with those of GASSENDUS in 1691, and that of Mr. HEVELIUS in 1671, from which he made several conclusions concerning the motion of the node and the inclination of the plane of Mercury to that of the ecliptic.

Upon this occasion several reflections were made upon the observation of Mons. GALLET of the oval figure of Mercury appearing in the sun. Mr. HENSAW supposed, that it might proceed from the refraction of an atmosphere about Mercury. Mr. Hooke conceived, that the body itself of Mercury might be of such a figure; and that it might proceed from the velocity of its whirling round upon its axis, he supposing, that the axis of its vertiginous or diurnal motion lies north and south, or at right angles with the seeming motion of it parallel to the : that a very swift vertiginous motion on that axis made the body of Mercury somewhat of the shape of a turnep or of a solid made by an ellipsis turned round upon its shorter diameter; and he explained this hypothesis by the shape, that a hollow globe of glass will readily run into, if the puntillon or pipe, at the end of which it is fastened, be whirled round very swiftly. And the reason, which he conceived, why it must needs be turned round very swiftly, was on account of its nearness to the sun, whereby the superficial parts would be burnt, if it were not for the swiftness of its motion.

Here by the bye Mr. Hooke explained his way, which he had formerly delivered

livered to Mr. **OLDENBURG**, of making use of glasses of any length without a tube; which was as follows: 389

A rope was so ordered, as to join the two ends together, and so to make a round rope. This was put through the pulley both at the top and bottom, and a large square or round board containing the object-glass, which was fastened within a frame, so as to make it inclinable towards the eye, where-ever posited; which was done by the means of certain strings fastened from the ends of the said board, and extended from it to the cell of the eye-glass.

After this, upon a further discourse concerning the appearance of Mercury in the sun, there was much said concerning the penumbra of shadows cast by the body of the earth and by the atmosphere thereof; and it was explained by experiments and reasons, what part of the light of the moon in an eclipse, especially that of the darkened parts, was to be ascribed to the penumbra or partial light from the sun, and what to the light cast on it by the refraction of the same in the atmosphere: and it was shewn, that that undefinedness of light or shadow, which was observable in eclipses of the moon, where part is shadowed, part enlightened, is to be ascribed to the penumbra or partial light of the sun: but that that light, which made the moon visible in a central eclipse, where no direct ray from the sun can come at it, must be ascribed to the refraction of the said rays by the atmosphere of the earth.

Mr. **HOOK** promised to produce at the next meeting some microscopical experiments, and particularly on some part of a muscle.

March 7. Mr. **HENSHAW**, vice-president, in the chair.

The minutes of the last meeting being read by Mr. **HOOK**, upon the mention of the air poise, and the experiment, in order to prove it, of weighing two bodies in water, it was very much doubted; though by the experiment of weighing in water the instrument became sensible, so as to turn by putting a little salt in the water: yet whether the very small changes of gravity of the air could be made sensible by such an instrument, was still a question. Mr. **HOOK** affirmed it, and that in order thereunto he would provide a glass blown large and light on purpose, and so order it, as that its variations or differences should be ten or twenty feet, if it were necessary; and consequently that it would be capable of discovering the smallest alterations of the air.

He added, that he would shortly bring in a new instrument for the discovering of some properties of the atmosphere not yet known or taken notice of, and hitherto altogether insensible to us, though by the said instrument they would be made evident, and their natures discovered and determined.

Upon mentioning the particulars taken notice of by Mons. **GALLET**, of the oval figure of Mercury, that subject was farther discoursed of, and Mr. **HOOK**'s hypothesis was objected to, viz. that though such an oval figure would be caused by the whirling round of a fluid body; yet it was probable, that the body of Mercury

Mercury is solid ; and consequently this whirling could have no effect upon it. To which Mr. Hooke answered, that though it might probably be now a solid body, yet that at the beginning it might have been fluid enough to receive that shape ; and that though this supposition should not be granted, yet it was probable, that there might be about Mercury some fluid body, somewhat of the nature of here upon the earth ; and if this must be granted, it would be probable that it would readily run into that shape, and make the same appearance : it is not improbable, but that the water here about the earth might do it measure, by the influence of the diurnal motion, which compounded with the moon he conceived to be the cause of the tides. But there were some other of explaining those appearances, which, when he had time, he designed to draw up in writing.

Some objections having been made against the way of making use of long telescopes without tubes, Mr. Hooke farther explained the way, and answered all those objections, and particularly that of Sir JONAS MOORE, who supposed it only theory, and that it had never been practised or made use of, Mr. Hooke affirming, that he had done it, and found it convenient enough in a glass of twenty-eight feet ; and therefore he conceived, that it might be as conveniently practised in a glass of any other length.

Mr. HILL desired, that the description of it might be fairly entered in the Register, that so such, as had occasion, might there receive instructions how to provide it, if they thought fit to use it.

The vice-president likewise moved, that the apparatus might be prepared, in order to shew the experiment of it at some meeting of the Society.

Upon a further discourse about the penumbra in eclipses, the vice-president said, that Mr. HEVELIUS had affirmed that penumbra to arise from the atmosphere about the earth. But Mr. Hooke asserted that to be a mistake, since the penumbra visible in eclipses of the moon proceeds from nothing else than the partial enlightning of such parts of the moon, as were in the penumbra by the light of the sun ; for those parts, which are in the middle of the penumbra, are enlightened but by one half of the sun, the other half being shadowed by the body of the earth, which by an experiment with the candle, and an explication of schemes, was made so plain, that there were no farther objections made against it.

Dr. ALLEN presented to the Society for their repository a *Locusta Marina*, which had this remarkable circumstance, that the horns thereof were covered with a shell, so thickly set with very small and exceedingly sharp points, that it might readily defend and keep off all such creatures, as should come between them to offend it.

Mr. HENSHAW observed, that the cock-lobster, which Sir GEORGE ENT had shewed at Arundel-House, had a double instrument of generation, as the female had also a double receptacle,

He remarked likewise, that the *bony* substances in the stomach of the lobster, commonly called the lady of the lobster, were nothing else than the teeth, by which the food was chewed and pressed, *doing* the office of grinders, or *dentes molares*. 391

Dr. GREW added, that there were muscles and other bones, by which their motion was commanded and regulated.

Mr. GEORGE ENT presented to the Society for their library the *Life of Mr. THOMAS HOBBS*, composed by himself in Latin verse*, and written with his own hand.

Mr. HOOKE attempted to shew a microscopical experiment of the exceeding smallness of the parts of the tendon of a muscle, viz. that it was not above a twentieth part of the bigness of a hair in diameter; and consequently that a hair was four hundred times bigger than one of these. But upon making trial thereof, the tendon was grown so dry, that those minute parts could not be discovered, tho' the same were plainly visible in the morning. It was desired therefore, that the apparatus should be provided against the next meeting; and that the tendon should be provided fresh and fit for this experiment.

Mr. HOOKE then shewed several sorts of animals, produced in the steeping of anniseeds, coffee, &c. in water. These were much smaller than those of pepper, and had a quite contrary motion.

March 14. Mr. HENSHAW, vice-president, in the chair.

Upon reading the minutes of the last meeting, wherein it was supposed, that the oval figure of Mercury might be caused by the velocity of its turbinated or diurnal motion upon its own axis, Mr. HENSHAW objected, that if it were so, why did it not always appear of that oval figure, when it was seen at its greatest elongation, as well as when it was in conjunction with the sun? To which Sir JONAS MOORE added, that Mr. FLAMSTEAD was of opinion, that it was caused by the refraction or defect of the glass, and proceeded from mistake, and not from any real appearance, since he could easily make it appear so with any glass: and that there were many other mistakes in the said observation, which therefore could not be relied upon.

Mr. HOOKE answered to both these objections, that the figure of Mercury might really be always so oval, as Monsr. GALLET had affirmed that he observed it; and yet through the inadvertency of others it might not be taken notice of, and that possibly for want of as good glasses as his, it might not have been visible before. To confirm which, Mr. HOOKE said, that Monsr. GALLET had noted, that even in this observation through the three feet glass it appeared round. Secondly, that the reasons, why it may not appear oval in its greatest elongation, may be

* It was printed at London in 4to, about three weeks after Mr. HOBBS's death, which happened 4th December, 1679. It is reprinted at the end of *Phil. HOBBSIANÆ Antiquæ*. three.

three of them: That it is very small and far distant, and very bright, all which circumstances make it very difficult, unless with very good glasses, to see any figure at all of its body, but only a radiating point. 2. That being seen only part enlightened, and never in opposition to the sun, the whole surface of it seen by us is never all enlightened, but only some parts of it; which is a sufficient reason to make it appear round, though the body of it be really oval, as is supposed; a part of this oval being really not seen, whereby the oval is changed into a circle. For it must be a very good glass, by which one is able to discover the true figure of Mercury, when half enlightened, by reason of its smallness and radiation; and it ought to be a very much better one to discover the figure of Mercury. 3. The figure of a dark body in a light medium is much better discovered than the figure of a light body in a dark medium, by reason of the radiation.

Next to Mr. FLAMSTEAD's supposition, Mr. HOOKE said, that it was no ways probable, that a man, who had made the whole observations with so much care, and with so many witnesses, and besides had so ingeniously and knowingly contrived the apparatus for observing it, could either be deceived himself, or endeavour to deceive others; and therefore, till there were better arguments than conjectures or hypotheses produced against these circumstances of the observation, it ought not to be rejected or condemned.

Upon the mention of using long telescopes without tubes, several objections were made, as the bending of the lines, the difficulty of raising and fixing it, and the like. But Mr. HOOKE affirmed, that he had actually done it; and that he had tried Mr. HEVELIUS's sixty feet glass without a tube, though it were afterwards tried also with a tube by Mr. COCK at Mr. OLDENBURG's desire.

Hereupon it was desired, that a trial might be made of it with a pole of ten feet long, that thereby the Society might be satisfied of the practicableness thereof; which Mr. HOOKE undertook to do.

Several discourses were made likewise about the penumbra, the result of which was, that it was concluded to arise from the partial enlightening of the parts in the penumbra, some parts of the luminous body being hid from them, whilst they were shined upon by others.

Mr. HOOKE then read a discourse of Signor CASSINI, concerning his farther prosecuting of the discovery of the diurnal motion of Jupiter upon its axis by the spot observable in one of the belts; wherein were several very remarkable circumstances and discoveries; that the same spot sometimes appeared for a certain space, and then disappeared again for a certain space: that the belts changed; and the two belts appeared like two rivers overflowing their banks, and running into one large one, with only some small spots or islands as it were between them: that the turbinate motion of Jupiter was sometimes swifter and sometimes slower, according as it more or less approached the sun: that he had stated the epoch thereof, and given the rule how to calculate for the future; that thereby the time of its coming to the middle of the disk might be observed to some few minutes of

of time; that from the greater number of revolutions Signor CASSINI had divided the whole space from the first to the last by the said number, and found it to be sometimes 9 hours, 55', 53", sometimes 9 hours, 55', 52", and 6'.

Dr. CROWE produced a phosphorus, the same with that of BALDWINUS, which he affirmed to have been made in England by an Englishman, altogether as good as that sent hither by BALDWINUS himself.

Mr. HAAK affirmed, that he had another of the same kind; and that he had observed, that it appeared white, if it were exposed to the light in the evening, when the sun was almost ready to set.

Mr. HOOKER read a discourse of his own, being an account of his observations, which in prosecution of Mr. LEEWENHOEK's discoveries he had made of the small worms in pepper-water, and in the steeping of several other liquors, as of barley, wheat, oats, anniseeds, coffee, &c. as also of sugar, alum, blood, milk, fat, ligaments, muscles, &c. and together herewith he discovered the several ways and contrivances by which he made those observations; and therein shewed, how easily and apt such persons are to be deceived by the appearances of these transparent bodies through a microscope, who are not aware of certain properties of And for the avoiding and preventing all these inconveniences, he shewed several ways and expedients, without which no true discovery could be made, and by the help of them they were very easily made. Some of those mentioned by him were the glasses plates, and plates of Muscovy-glass, particular kinds of light, the immersing the bodies in waters and other liquors, the squeezing bodies between two glass-plates, the stretching and squeezing others with a kind of tongues, &c. whilst they are looked upon in a convenient light by the eye. After which he shewed the method, by which he made two sorts of microscopes, and the conveniences and inconveniences of both these.

The first was a single microscope made by a small globule of glass, by means of which, with very little or no difficulty, any object might be prodigiously magnified.

He also explained how the globule was made out of a thread of glass, and how that glass thread and small glass-canes were made.

The second was a double microscope consisting of two glasses, whereby many observations might be more conveniently made than with the single one. He then explained how, by the help of these, the parts of a muscle, fibre, tendon, ligament, &c. might be examined; and to verify this by experiment, he produced a small part of the ligament of the neck of a sheep, and shewed it to consist of an infinite number of exceedingly small threads, four hundred of which would scarce make the bigness of one single hair of a man's head. But as to the fibres of a muscle, he affirmed them to be very different, which he would have other

Dr. CROUX shewed a stone, on which a piece of alga was growing.

March 21. The president and vice-president being absent, Mr. DANIEL COLLINS was desired to take the chair.

After the minutes of the last meeting were read, a discourse arose about BALDWINUS's phosphorus, concerning which it was affirmed, that the same was then made in England as good as that, which was brought from beyond sea: and it was desired, that one of them might be procured to be examined at the Society at their next meeting: which Mr. Hooke said he would endeavour to do.

Mr. Hooke read a letter and relation, which he had received from the president, being both sent him from captain RICHARD ROLLAND from Tangier, 13th February, 1671, containing an account of his trials made in the deeps of the sea; wherein he observed, that having, according to Mr. Boyle's directions, lowered by the deep sledge line a bottle of oil of anniseeds, and two other bottles only filled with air, into eight fathom water, and there suffered them to stay a quarter of an hour, the oil was congealed, and the cork driven into the bottle; but the stopper had leaked through its pores, through which the same upon pulling up endeavoured to get back, making a noise and smoke.

The second experiment was with three bottles in an hundred fathoms water. The two bottles stopped with lignum vitæ were broken by the pressure of the water drawing them into the neck: the other stopped with cork was taken up whole, but the cork driven into the bottle, and the bottle filled with water; which being tasted, seemed somewhat fresher than the rest.

Upon this, a discourse arose about more exact ways of making these kinds of trials in the sea and other deep places. And Mr. Hooke affirmed, that he had a way to examine the pressure to any depth with the greatest ease imaginable; and that was by a cane of glass, with which there had been several trials made near Sherborn, of which there is an account in the Registers of the Society. That he had also other ways for examining the heat and cold of those submarine regions; and to fetch up the water from any depth; as also the earth, sand, &c. from the bottom: that he would give directions for the making of such an apparatus, if there were proper persons appointed to make trial with them.

Hereupon mention was made of great depths of waters within land, as of that of the lake of Geneva many hundred fathoms deep.

Dr. MAPLETOFT related, that cardinal D'ESTREES had caused the lake de Aqua by Padua to be sounded, but could find no bottom with a whole boat-full of line.

Mr. HILL mentioned, that the sea was so very deep at Messina, that the admiral of Spain could ride close to the key, and no bottom could be found by

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Mr. THOMAS SMITH related, that by Mr. JOHN GREAVES'S experiment no bottom could be found at the Straits at a thousand fathom depth. 393

Mr. WHEELER affirmed, that there was a pool or lake in Wales, of which no bottom could be found.

Mr. HILL supposed, with good reason, that in trials of this kind, the lightness and buoyantness of the rope might at length keep the weight from sinking any farther; and so much more line might be taken into the sea than was necessary to measure the depth. It was thought also, that the motion of the under-parts of the water might bend the line very much.

Upon this mention was made of the bending of the line of a pendulum hung from the top of St. Paul's before the fire; as also of some other experiments about trying the particular gravitation of bodies near to and at a distance from the surface of the earth; of which there are several accounts in the Society's Registers.

Dr. CROWE moved, that there might be made an universal index to the Registers.

Mr. HOOKE shewed in the microscopes the manner how tallow coagulates, in order to explain the expansion of water upon freezing: and

The manner of the shooting of sugar dissolved in water upon the glass-plate of the microscope.

1678. March 28. Sir CHRISTOPHER WREN, vice-president, in the chair.

Upon reading the minutes of the last meeting, a discourse was occasioned concerning the ways then spoken of for founding the depth of the sea by the help of a long pipe of glass, the lower end of which was perfectly sealed up hermetically, and the upper end so ordered, as upon its descending to admit of the water to enter in, according as the pressure of the water was greater and stronger upon the inclosed air; and upon pulling up again of the same pipe, and so as the pressure of the water decreasing, the air expanded itself, and found its way out without forcing out again the water, which had been admitted in its descent.

Sir CHRISTOPHER WREN objected to this, that the compression of the air might be occasioned by the cold as well as the pressure of the water; and so it could not be distinguished which part of the pressure of the air was to be ascribed to the cold, and which to the pressure.

Mr. HOOKE answered to this, that it was necessary that there should be other instruments let down with the said pipe, in order to find the degree of coldness in the water at several depths below the surface; and that the said experiment was not less instructive than the other: for the performing of which he alleged that

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that he had a contrivance, by which the same might be certainly examined, and thence the degrees both of the one and the other might be defined.

Some other objections were made, that the depth might be examined by the help of a line, as well as by the degree of pressure. To which it was answered, that as for the meter finding the depth of the sea, the line and plummet were not sufficient, because in great depths the line would be buoyant, and so not be strained straight; and where there was a motion of the water, the line would be often much sloped, and sometimes much bended. But besides the examination of the depth, this tube served also to inquire into the degree of pressure at certain depths: which was another useful inquiry, and likewise helpful for the finding the qualities of those lower regions as to heat and cold; which was a third inquiry worthy to be examined.

Sir CHRISTOPHER WREN seconded Dr. CROWE's desire of having an universal index made to the Register-books.

He alleged, that he had not heard any real objection against the wooden balls for sounding the depths of the sea. To which it was answered, that these balls being ordered, as was directed in the *Philosophical Transactions*, would certainly perform the effect, if care were taken to observe exactly when the balls appeared again above water; which was easy to be taken notice of in small depths, and where the water was without motion. But where the water or the ship were in motion, so that the ball did not ascend again into the same place, where it descended, and where the depth was very great, there the observing of the moment, and the place where it appeared again after it had been sunk to the bottom, was very difficult, and hardly practicable. But as to the way of ordering the ball and weight, which was presented by RICCIOLUS, it was very fallacious, the ball frequently letting go the weight before it came to the bottom; and at other times being detained altogether at the bottom without separating from the weight, as had been found by trial; of which an account was entered in the Register-book.

Mr. HOOKE shewed an observation of the figure of the small and imperceptible parts of a muscle, which he had discovered by the help of a microscope. The muscle, which he had made choice of for examination, was that of a lobster's claw, the fibrous part thereof; since first the tendon is nothing else but a bone, and so ed immediately to the inside of the shell.

In this observation notice was taken, that the small fibres sought for, though as much magnified and inlightened as was necessary, did not appear till by the adding a small drop of water the irregular refractions on the outside of the fibre were removed; after which it was very plainly visible, that the whole fibrous part of the muscle examined consisted of an indefinite number of exceeding small strings, extended straight between the inside of the shell and the tendinous bone in the middle, which

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which were so small, that five hundred of them would scarce exceed the bigness of an hair.

Each of these small fibres or strings was conceived to be seen of the shape and figure of a wreathed pillar, or a stick naturally grown wreathed by the twisting thereof was left till another time. Others supposed it of other shapes. But the determination

Mr. MOSES PITT, bookseller, having made a proposal to the Society of his design of printing an Atlas, or description of the parts of the earth, sea, and heavens, contained in about six hundred copperplates or maps, and about nine hundred printed sheets; and desiring the assistance and encouragement of the Society for the more exact performance, and the better carrying on of this work; it was referred to Sir CHRISTOPHER WREN, Sir JOHN LOWTHER, Mr. HILL, Mr. HAAK, Mr. HOOKE, Dr. GREW, and Mr. COLLINS to consider farther of this proposal, and to report their thoughts of it at the next meeting of the Society; and the time of this committee's meeting was appointed on the Tuesday following, at six o'clock in the evening.

April 4. The president in the chair.

The minutes of the last meeting being read, Mr. HENSHAW, upon the mention of the ways of sounding the depth of the sea, asserted, that in cardinal CUSANUS there was another way of sounding it, different from those which had been described by Mr. HOOKE, both by the help of a pipe, and also by the descent of a ball sunk by a weight; which weight leaving the ball when it came to the bottom, the ball ascended with the same velocity upwards, with which the weight and ball together descended to the bottom.

Hereupon Mr. HOOKE explained the peculiar contrivance of the application of the leaden weight to the ball, which he had invented and made use of, being the same, which was entered in the Society's Register. As also he shewed the uncertainty and inconvenience of the other contrivance, he having experimentally found, that it would often fail of performing the desired effect, either by leaving each other before they came to the bottom, or not separating at all when they came thither.

The president, Mr. HENSHAW, and Mr. HILL made several objections against the way of sounding the depth of the sea by the aforesaid contrivance with a ball sunk by a weight: the chief of which were founded upon the supposition of GALILEO, that descending bodies accelerate their motion continually in a duplicate proportion to the time of their descent; and therefore it seemed hard to conceive, how the theory propounded by Mr. HOOKE would hold true, viz. that the time of the descent and ascent of the ball is always in the same proportion to the depth of the sea, be it more or less, provided it were about two fathoms in the water. The reason of which he alledged to be, that by passing about two fathoms in the water,

water, the ball both in *ascending* and *descending* would arrive to its *greatest* degree of velocity.

The president farther urged, that GALILEO, GASSENDUS, and MERSENUS had all affirmed the same thing, that all *descending* bodies accelerate their motion in proportion to the squares of the times of their continued descent: and that they had, upon this supposition, been at the trouble to calculate the time, that a body would spend in descending to the center.

Mr. Hooke answered, that those calculations had been made upon a theory, and not upon experiment; for that experiment would evidence the contrary. And though in a *vacuity* of water, air, or any other gross fluid, those proportions would hold very near; yet in a medium, wherein there was a resisting fluid body, it would not hold in any wise, especially in those, which had a considerable proportion of specific gravity to that of the descending body. Hence he said appeared the reason, why a down-feather being let fall in the air would descend therein, if it were not disturbed, by an equal degree of velocity. But on the contrary, if the said feather were let fall in a medium, whence all the air was exhausted, and nothing but a fluid æther left, he affirmed, that it would fall therein, as to sense, with the same accelerated velocity, that a stone would do in the open air. This, he observed, he had formerly shewed to his majesty at White-hall. But that upon admitting the air into the space, through which the feather was to descend, it was plainly seen to descend with an equal degree of velocity the whole space, which was all the way very slow. He added, that in *vacuo* the descent of all bodies was equally swift, increasing continually its velocity by a duplicate proportion to the time of continuance; but that in all gravitating mediums somewhat of that proportion is impeded. Hence he affirmed, that in the experiments tried from the top of St. Paul's steeple it was very plainly visible, that a leaden ball would descend faster than one of the same bigness of wood, and that of wood faster than one of cork; inasmuch that the heaviest would in that descent get near thirty feet before the other to the bottom. He further added, that even of bullets of the same substance the bigger would manifestly outrun the less in their descent.

As also, that all mediums whatsoever had some resistance to the motion of bodies through them, and that even those, which had least, had yet a very considerable opposition to a motion, that was proportionably accelerated. Hence it was, that birds were able to sustain themselves in the air; and that one might break the strongest oar by swiftly striking it again the water.

And farther, that in the thinnest medium, though the acceleration were pretty nearly true, but that there would be in all mediums a certain degree of retarding, which the same descending body would never exceed, though other descending bodies might, and some others would never arrive to: after which degree was attained, the progress of the body would always be made by equal spaces in equal times,

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times, though ever so far continued, provided the gravitating powers remained the same.

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Notice also was taken, that GALILEO had supposed, that the motion of a common pendulum was isochrone; but that it was afterwards experimented by MERSENNEUS, that this assertion would not hold; though the other problem of GALILEO of the isochrone descent of a body upon the inclined plains within the circumference of a circle were mathematically and mechanically true:

That Monsr. HUYGENS was the first, that found out, that the motion of the weight of a pendulum in a cycloid would make all its excursions isochrone; but that he was not the first, who applied the pendulum to a clock for the regulation thereof.

Sir JOHN LOWTHER queried, who it was, that first found out, that the motion of the descent of heavy bodies was not the same with what GALILEO had asserted.

Dr. CROONE supposed, that it was Monsr. MONCONYS; and that he had it from a Jesuit in France. But Mr. HOOKE thought, that this was discovered long before; and did not remember the mention of it in the travels of Monsr. MONCONYS; but remarked, that the Jesuit RICCIOLUS had mentioned it long before in his *Ame-ga*.

Dr. CROONE added, that Dr. CHALERS in his *Curfus* had said much concerning it both from his own experiments and those of others.

Mr. HOOKE shewed an experiment of the compression of the water in a glass-pipe, in order to the exhibiting the experiment of examining the depth of the oceaning it, viz. that the effect answered to what was asserted concerning the proportionate to the depth of the glass.

April 18. Sir JONAS MOORE, vice-President, in the chair.

The minutes of the meeting of 4th April were read, which gave occasion to discourse concerning several ways of sounding the depth of the sea.

Sir JONAS MOORE related, that he had made many trials with the ball and weights of lead for the sounding the depth of the sea: and that he had found it exceedingly difficult to determine any thing by them; by reason that it was almost impossible to discover them certainly at their first appearing above water, though they would often leap into the air to a considerable fathoms from the place, where they were let down into the water. That of twelve, which he had tried at the Straits of Dover, not one was found at its first appearance. He therefore conceived, that they would be of very little use in the ocean, though they might be of use in very deep lakes, such as that of Geneva, &c.

Here.

Hereupon a farther discourse was occasioned concerning the motion of ascending light bodies; and whether bodies ascending from a greater depth would not move much swifter towards the latter end, and poise higher than those, which came from a less depth. And it was alledged, that a ball of such a poise as those made use of for sounding the depth of the sea, would in its ascending acquire a considerable velocity. But that degree being acquired it would not be more accelerated, though it ascended ever so much farther.

Dr. CROUNE moved, that a theory of this matter might be brought into the Society.

Sir JONAS MOORE alledged, that in shooting granados he had found, that the greatest random was below forty-five degrees of inclination. And that shooting at twenty degrees would fly much farther than shooting at seventy: the reason of which was the density and resistance of the air to the body passing through it, whereby that, which was shot at seventy degrees, passing through a greater quantity of air, received a greater impediment and hindrance from moving exactly in a parabolical line, than that which was shot at twenty.

Sir JONAS MOORE farther observed, that the different density of the air at one time more than at another would cause a greater impediment and deviation of the bullet at that time more than at another: that the motion of the air or wind would often bend the bullet considerably out of its directed way: that the hollowiness of the shell would many times make it pass in a curve and not in a strait line; for that he had several expanded canvasses set up all exactly in a strait line; and that upon shooting directly in the line he had observed, that a bullet had passed through the first and last, and yet missed all the intermediate ones by deflecting either to the right or left side of them.

It was then moved, that some experiments should be made at the column^t on Fifth-street hill, of the velocity of the descent of heavy bodies, and what the resistance of the air is to that motion.

Mr. HOOKE affirmed, that he had a design to make several experiments concerning that and other matters at that place; of which he would give the Society an account; as he had formerly done of those made at St. Paul's before the fire of London. He took notice, that there were in Ricciolus's *Almagestum Novum* a great number of such experiments made at Bologna at the tower of the Asinelli.

Dr. CROUNE alledged, that Monsieur DE CHALES in his *Cursus* had given a theory of the resistance of the air to bodies moved through it, together with a great number of experiments to that purpose.

Sir JONAS MOORE related, that a hurricane blowing off the ball from the top of the steeple at Durham, the ball had acquired so great a velocity in its fall from

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so great a height, that it sunk itself at least four feet into the ground; which he supposed to have been occasioned by its great bulk and the great height of the place whence it fell. 401

Mr. Hooke moved, that for the examination of the descent of heavy bodies at Blackheath; in which trials observation should be made of the time of their ascent and descent; which might be very easily done, this being very visible at a distance.

Mr. Hill alledged, that in Ricciolus there is an account of an experiment of shooting a bullet perpendicularly upwards; and that it had always been found to fall to the westward of the place, whence it was shot.

He added, that by many experiments tried at Dover Castle it had been found, that no gun in that place would shoot above a mile and an half into the sea: the reason of which was shewn to be the proportion between the velocity of the horizontal and perpendicular motions.

Mr. Hooke shewed the microscopical figure of the fibres of a muscle, and explained the reason of their motion by a wreathed helical gut and a strait string, helical and shortened, being twisted about the gut: but when the gut was suffered to empty itself of the air, the string lengthened and became strait, and the gut twisted about it in a helical figure.

Mr. Hooke proposed also an experiment for the next meeting, to shew how the motion of the muscle might be explained, supposing the said fibres to be (like joined together by the necks. It represented) a string of small bladders

Monf. PAPIN, who was admitted to be present, shewed an experiment of a wind-gun of his own making and contrivance.

April 25. Sir CHRISTOPHER WREN, vice-president, in the chair.

The minutes of the last meeting being read gave occasion to discourse concerning the resistance of the air to bodies moved through them; and particularly concerning the figure, in which a granado is moved; how near it approaches to a parabola; and in what it varies from it: that in the motion of lesser bodies in lesser spaces the figure is so near a true parabola, that it is not possible, by any instrument yet known, certainly to describe one nearer to the truth.

Sir CHRISTOPHER WREN alledged, that he had by many trials found, that he was able by binding and fixing fast his barrels, to shoot three shots in five into the same holes.

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Sir JOHN HOOKER mentioned, that Sir JONAS MOORE had affirmed, that he had done much the same thing with a cross bow fixed fast to a rest, and *breasting* an arrow.

It was alledged, that those guns carried truest and surest, which were exactly bored and polished within, and that had a bullet exactly fitted into it; or that was forced through it by the strength of the powder.

After this a discourse was occasioned concerning the motion and fabric of muscles. And Mr. HOOKER shewed an experiment in order to the explanation thereof, which was a chain of small bladders fastened together, so as that by one pipe the whole series might be filled; which they would be successively, one after another, that, which was next the pipe, being first filled, and then the next successively. Now it was supposed, that the globules of the fibres of the muscles, which seemed like a necklace of pearl, might be some fabric, as this of bladders, in which might be included a certain portion of air or other very agile matter; which air being included in so exceedingly small and very thin skins, was very easily wrought on by heat and cold, and other agitating properties of the liquors, that pass between them; and thereby they might be presently filled by the said included air being rarified and emptied by the condensation of the same from the want of that heat continued: and so by the successive rarefaction and condensation of the same air included in the aforesaid chain of bladders the string thereof was made either shorter or longer, each of which was so much the more, by how the rarefaction or the condensation was the greater.

Upon this an occasion was taken, to discourse of the causes of the motion of the muscles; and how far the air taken in by the lungs might contribute towards muscular motion. And it was thought, that it was of great necessity for that very purpose.

Dr. KIRK was of opinion, that the motion of the muscles proceeded from the liquor of the nerves, and alledged the exceeding minuteness of the divarications thereof, in so much that with a microscope it was possible to trace them till they were much smaller than the hair of a man's head, and yet might be found that he had tried these small divarications into the very middle of the body of these muscular fibres. He remarked, that both might be necessary to produce that motion.

Mr. HENSHAW objected, that the divers for sponges and corals at Samos could hold their breath three quarters of an hour. Upon this also he mentioned some observations concerning the *foramen osseum*, by which the blood of otters was supposed to pass from one ventricle of the heart to the other, without passing through the lungs: and thence it was supposed, that there was less need of the motion of the lungs or breathing, since it was thought, that the great use of the motion of the lungs was for the making the blood pass through them.

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But against this he alledged, that in his opinion the otter had no *foramina* ⁴⁰³
 which Sir CHRISTOPHER WREN positively asserted, having dissected and examin-
 ed an otter for that purpose.

Dr. KING affirmed, that an otter could not continue under water without
 breathing above four minutes, and then must of necessity come up and breath-
 ing. And so long almost any man in cold weather was able to abstain from breath-

Sir CHRISTOPHER WREN related, that the seal, that was in St James's Park,
 had muskles, by which it could * * up the nostrils, and so sink itself, and
 lie at the bottom of a pool made for him, for a great while together; and that
 it would eat its food at the bottom of the water.

Then the discourse of muscular motion, was farther prosecuted: and it was sup-
 posed, that those chains of globules might be filled with other liquor, as well as
 with air. But Mr. Hooke alledged, that the spirit of wine and divers other spi-
 rituous liquors were pretty suddenly susceptible of the degrees of heat and cold;
 yet in comparison with the exceeding sensibility of the air they were very flow-
 ing and dull: and in order to explain this he promised to produce at the next meet-
 ing a glass, which should experimentally verify it.

Sir JOHN HOSKINS objected, that the motion of the muscle could not be
 from the swelling or shrinking of the air: for that Dr. GODDARD had, by an ex-
 periment made in a vessel of tin, in which a man's arm was included, proved,
 that the arm took up no more room in the water, when the muscles were intended
 and made use of to pull, than when they were suffered to lie still without straining.
 To which Mr. Hooke answered, that that experiment was not at all sufficient
 to prove or disprove the swelling or shrinking of the muscle; for that there be-
 ing always some muskles, which counterbalance the other, and that as much as the
 antagonist muskles together, so the same space is always filled by the two

Sir CHRISTOPHER WREN supposed, that the swelling and shrinking might
 proceed from a fermentative motion arising from the mixture of two heterogene-
 ous fluids.

Some difficulties occurred in this hypothesis, how the motion of some muskles
 should continue so long after they were cut off from the body of the animal. Men-
 tion was made of the muskles of the skin in flaying a dead animal & of the parts
 of reels cut asunder, of frogs stirring after the heart, lungs, and entrails were tak-
 en out.

Mr. Hooke affirmed, that he had observed the heart of a mormon fish to beat
 many hours after it was cut out of the body.

May 2. Mr. HENSHAW, vice-president, in the chair.
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The minutes of the last meeting being read, wherein mention was made of the parabolical figure described by a bullet, and inquiry being made concerning the figure proper to each inclination, it was shewn, that the figure described by a bullet shot with any inclination whatsoever is a parabola.

Upon occasion of a discourse about respiration, Dr. CROUNE mentioned an experiment made by Dr. MERRET of keeping young puppies a long time without respiration, by suffering them to remain in their secundine after they were taken out of the dam. This observation was confirmed by Mr. HOOKE from his own trial; and he added, that he had found the heart of one of them beat the next morning, which he had taken from the dam the night before.

Dr. CROUNE hinted, that a creature might be killed before the *foramen ovale* could be closed.

The vice-president answered to this, that it was a question, whether the *foramen ovale* might not be closed before the birth; because it had been observed to be closed immediately after the birth; and therefore it was not probable, that it could be done so suddenly.

Dr. CROUNE supposed, that there were other uses of the *foramen ovale* than had yet been ascribed to it; for that he had observed, that the blood circulated throughout the lungs, as well after the exhausting the air by the wind-pump out of them as before: so that he supposed also, that even before the child had breathed, there might be made a circulation of the blood even through the lungs of the fœtus.

Upon this occasion much was discoursed about the fabric of the lungs, and how the air might be clean drawn out of them by the wind-pump, though it could not be expressed out of them by pressing them without breaking the little bladders.

Mr. HOOKE explained the reason, why this effect might be performed the one way and not the other: and that was, that the little bladders, out of which the lungs were composed, were joined to the branches of the *aspera arteria* like leaves to the sprig of a tree: that the holes, by which the *aspera arteria* leaves their bladders communicated, opened and closed according as the bladders were more or less expanded: but that they became perfectly closed up, when the bladders were not bigger than such a determinate magnitude.

Mention was made of divers, who refreshed themselves by the help of sponges dipped in oil. This was taken notice of upon Mr. HILL's mentioning, that MER-sinns had related, that a diver could hold his breath, and continue under water six hours and a half without coming up to fetch breath: but that he had re-minformed.

Mr. HENSHAW added, that the seal in St. James's Park usually received its food
at

at the top of the water and upon the land, and then dived to the bottom and eat it there.

It was discoursed, that the specifical use of the air or respiration was difficult to guess it; for some experiments had proved, that there might be a circulation without the motion of the lungs; and that a man might be stifled, though he moved his lungs and breathed, if it were not fresh air. This was thought a good argument to prove what Mr. Hooke had asserted, that air was the pabulum of the animal spirits, and that, which was the principal cause both of the heat and animal motion; for that the blood was in the lungs both impregnated with fresh air, and so received an invigorating florid arterial colour, and also discharged great quantity of steams and fuliginous matter, that was contained in it.

This gave occasion to discourse of the reason, why several creatures leave a scent behind them, where they pass; so that dogs are able to follow them thereby a good while after they had passed along.

Mr. HILL observed, that in hunting a deer, the dogs would not always take the scent from the ground, but sometimes also from the boughs of trees, or any other thing, whereon the breath of the deer might settle.

Upon this discourse it was farther observed, that there were continual steams issuing from animal bodies, not only by the lungs, which vented the greatest quantity, but even from all the other parts of the body. And it was remarked, that if a man in cold weather stands with his shoes upon a marble stone, he would presently leave an impression behind him upon the stones, though his shoe-soles were perfectly dry, as was presently experimented. It was judged, that by some such steams as these left on the ground, upon which a man walks, a dog might be able to follow him by the scent.

It was hereupon observed, that the vapours, that perspire through the skin, make a kind of atmosphere about a man and other creatures; and thence in cold weather those vapours being condensed into water become visible, as was more that the wearing of an oiled case upon a hat would make the hat within very wet; as also the wearing of cap of salve or lead.

Hereupon it was suggested by Mr. Hooke, that probably the healing of plasters might be from nothing else than the keeping of the air from preying upon the tender wounded part, and from keeping in the moisture to keep it tender and supple.

The use of the skin of an egg for healing of fresh wounds was also mentioned; as likewise that this was the reason, why a dog heals his wound by licking it, keeping it thereby clean and moist.

Mr. COLWELL related, that though the egg skin might be good for the healing of green wounds, yet that it is not so for healing of old ones; for the he knew a person, who by wrapping up his finger in it, had mortified it.

By the bye mention was made of the foot of a bear, which by STENO was observed to be much fuller of glands than that of other creatures: and this was supposed to be the reason, why bears were observed to suck their feet so much in cold weather, as containing a liquor laid up by nature: and it was observed, that thereby the fat of the bear wasted.

Mr. HOOKE read a discourse and relation of a voyage made by a gentleman to the top of the pike of Teneriffe, and of the remarkable particulars observed there by him; of the water and ice in the cave: of the heat and sulphur of the caldron at the top: of the cold and penetrating winds: of the clear prospect of an island at a good distance: of the continuing of the taste of wine and strong waters: of the reputed height, and of the vast stones, that seemed to have rolled down from the top.

An experiment was exhibited, to shew how exceedingly sensible the air is of the alteration of the degrees of heat and cold. And it was made use of to explain how the motion of the muscles might be effected, supposing them to consist of an infinite number of such small bladders strung together, as had been shewn at the last meeting by the microscope in the muscle of a crab.

May 4. At a COUNCIL held at Sir CHRISTOPHER WREN's were present

Sir CHRISTOPHER WREN, vice-president,	
Sir PAUL NEILE,	Mr. HENSHAW,
Mr. HILL,	Mr. HOOKE.

It was ordered, that the iron chest in the gallery of Gresham-College be opened on the Thursday following in the presence of a vice-president and any two of the council; and that an inventory be taken of what was contained in it; and that Mr. HUNT provide forthwith convenient padlocks for it:

That Mr. HOOKE treat with Mr. LEM concerning Chelsea-College, and give an account of his proceedings at the next meeting of the council:

That an index be made of all the material things contained in the Council-book by the advice of the secretaries; and that a reasonable allowance be made to a fit person to do the same: And,

That Mr. HENSHAW, Mr. HILL, and Mr. HOOKE, be desired to go to Chelsea-College, and to get a survey of it sometime before the Thursday following.

May 9. At a meeting of the SOCIETY, Mr. HENSHAW, vice-president, in the chair.

The minutes of the last meeting being read gave occasion of much discourse concerning respiration, and of what use the air might be for continuing sense, motion, and life.

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Sir ⁴⁰⁷JOHN HOSKYNs was of opinion, that the use of the lungs might be to alter, prepare, and dispose the air so, as to separate a part thereof, and make it fit for mixing with the blood, as it passed through them, somewhat analogous to those operations, which are performed by other viscera upon other juices of the body; and for separating also at the same time apart from the blood, as the liver separates the gall, the kidneys the urine, &c.

The vice-president was of opinion, that a principal use of the lungs is for the promoting of the circulation of the blood.

It was objected to this, that the motion of the lungs was not at all necessary to the circulation, because a dog could live, though his lungs were kept motionless, by being continually blown up and kept extended by a pair of bellows: that a dog would be kept alive, though the lungs were not kept fully extended, provided there were a continual blast of air, that passed through them: and farther, that a creature would be stifled and die, though his lungs moved, if it did not breath fresh air.

It was therefore concluded, that the principal use of respiration is for the mixing the nitrous part of the air with the blood; which part of the air being once spent and separated from it, the remaining part thereof is altogether useless for that purpose.

To this it was objected, that if there were such a constant and continual necessity of fresh air, how comes it, that the foetus included in the secundine, as had been lately mentioned, would continue to live, though it had no fresh supply of fresh nitrous parts of the air from the lungs, which would not move at all?

And Mr. HENSHAW mentioned the person in Sweden, of whom there is a fuller account in the books of the Society, who being drowned and frozen up in ice for a considerable time, was afterwards dug out, thawed, and brought to life again, and had been seen by many in Sweden, with whom Mr. HENSHAW had spoken.

Mr. COLLINS cited upon this occasion PACHINUS's history:

It was farther supposed, that the greatest transpiration of the body was made by the lungs; and that some creatures scarce sweat at all. Whereupon Dr. ACETUSALIVA suggested, that the drive of a dog heated with running is not ordinary saliva, but seems to be the sweat of the dog mixed with it.

Upon the mention of the relation, read at the last meeting, of the journey to the top of the pike of Teneriffe, several debates arose concerning the height of the clouds and the nature of them.

Sir JOHN HOSKYNs observed, that according to this relation the clouds were

as high as the top of the pike; and that they sometimes covered it, and made the earth very moist and clammy.

Dr. WALLIS and some others affirmed, that they had ridden through clouds at the tops of hills, which there appeared a mist; but both before they entered it, and after they had passed it, it looked like a cloud, and was really nothing else.

After this a Latin letter was read from THEODORUS KERCKRINGIUS sent to the president, and dated at Hamburgh, 4th February, 167 $\frac{1}{2}$ *, returning his grateful acknowledgments for the honour and favour done him by his election into the Society, and declaring his desire and readiness to serve their design to the utmost of his power.

The experiment appointed for the next meeting was the trial of the mercurial experiment at the column on Fish-Street-Hill.

May 30. At a meeting of the COUNCIL were present,

Sir CHRISTOPHER WREN, vice-president,	
Sir JONAS MOORE,	Mr. HALL,
Sir JOHN LOWTHER,	Dr. HOLDER,
Sir JOHN HOSKYNs,	Mr. HILL,
Sir PAUL NEILE,	Mr. HOWARD,
Mr. HENSHAW,	Dr. KING,
Mr. COLWALL,	Dr. WHISTLER,
Dr. GREW,	Mr. HOOKE.

It was ordered, that Sir JOHN HOSKYNs, Mr. HENSHAW, Mr. HILL, Dr. GREW, Mr. HOOKE, or any two of them, be a committee to consider of the best way of disposing of Chelsea-College; and that they have full power to treat and agree concerning the disposal of the said interest to the best advantage of the Society in their opinion: and that Mr. HOOKE do from time to time appoint the meetings of the said committee, and accordingly send notice thereof to the members of it.

At a meeting of the SOCIETY on the same day.

Mr. HENSHAW, vice-president, in the chair.

The minutes of the meeting of May 9, being read gave occasion of discourse concerning the reviving of persons, who had been drowned for a considerable time: upon which subject it was alledged, that PECHLINUS* had written a long discourse, of which the Society had received a particular account from Monsi. STIERNHELME the resident of Sweden.

* Letter-book, vol. viii. p. 31.
was printed at Kilon in 1676.

* NIC. PECHLINUS, whose book *de Aeris & Alimanti defectu*

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Sir JONAS MOORE gave an account, that Mr. EDMUND HALLEY, who went to the island of Saint Helena, in order to observe the true places of the stars near the fourth pole, was newly returned to England; and that he had completed his design by having taken the true places of above four hundred considerable stars; that the place of his observation was above a thousand yards higher than the surface of the sea: that by reason of that great height there were almost continual clouds and mists, which passed very swiftly: that this mistiness and moisture of the air dissolved the glue of the tubes: that he observed, that these clouds and mists arose immediately out of the sea on one side, and passed over the island, and fell down on the other side: that this mistiness was only over the island, and not on the encompassing sea: that the air was extremely temperate and helpful: and as an argument hereof he related, that a couple having gone over from England to inhabit there, the husband being fifty-five years of age, and the wife fifty-two, the wife was big with child, and ready to be delivered when he came from thence: that the island afforded plenty of wild partridges and turkey hens: and that the whole island seemed to be one intire rock standing in the middle of the sea.

Sir JONAS MOORE undertook to discourse Mr. HALLEY farther concerning his other observations, and to give the Society an account thereof.

Mr. HOOKE read part of a discourse sent him by Mr. JAMES YOUNG of Plymouth, containing a brief description of the island of Mayo and of the bay in that island, from which salt is brought; together with his observations on a well dug in the sand for the procuring of fresh water; which, though almost encompassed with the sea, afforded notwithstanding a good quantity of water pretty fresh.

With regard to the producing of water by this way, viz. by the straining of salt water through the sand, the vice president very much doubted of it, as being a thing hitherto not known; nor was there yet known any other way of filtration, that would make a separation of fresh water from salt water.

Dr. WHISTLER observed, that all over Holland, Zealand, and West Friseland, where the country lies lower than the sea, there could be no springs found by digging.

Mr. HOOKE then gave an account of some experiments, which he made with Mr. HUNT and Mr. CRAWLY at the Pillar on Fifth-Street-Hill, concerning the difference of the pressure of the air at the top and bottom of the column and at several intermediate stations: and he affirmed; that he had found the quicksilver in the tube to stand higher at the bottom of the column than at the top of it by near a third part of an inch; and that he had observed the same to accord by degrees, as near as he could perceive, proportional to the spaces descended in going down from the top of the column to the bottom: but because the stations of the mercury were different from one another but very little, and so it was not easy to determine the certain proportions of the one to the other; there

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fore he propos'd against the next meeting an experiment to be tried at the same place with an instrument, which would determine that distance an hundred times more exactly: which instrument also he there produced, in order to explain the manner thereof, it being made upon the same principle with the wheel barometer, but more curiously wrought.

The experiments with his instrument were appointed to be tried at the column upon the Thursday following at eleven o'clock in the morning.

June 6. At a meeting of the COUNCIL were present

SIR CHRISTOPHER WREN, vice-president,	
SIR JOHN HOSKYN,	Mr. HALL,
SIR JOHN LOWTHER,	Mr. HILL,
Mr. HENSHAW,	Mr. HOOKE.

It was order'd, that the treasurer pay to Mr. HOOKE the sum of forty-five pounds for his allowance as curator of the experiments of the Society for a year and half ending the 24th of this instant June.

It being mentioned by Mr. HOOKE, that Mr. JOSEPH LANE, comptroller of the chamber of London, lately elected a member of the Society, desired to be excused from the usual payments thereof, upon his allegation, that he would otherwise be ready to promote the design and good of the Society, and to be assistant to them in matters of law; it was thought fit and order'd, that he should be excused from the said payments upon his subscribing the engagement to perform the other duties incumbent on a fellow of the Society.

It was order'd, that Mr. HOOKE be desired to go to the library at Arundel-House, there to meet Sir WILLIAM DUGDALE, garter king at arms, and to receive his proposals concerning the books of that library, which concern heraldry and genealogy, or the history of the family of Norfolk, which his grace the duke of Norfolk had reserved, when he formerly granted the rest to the Society: and that Sir JOHN HOSKYN, Mr. HILL, and Mr. HALL be desired to accompany him on the Friday following at three in the afternoon.

At a meeting of the SOCIETY on the same day,

SIR CHRISTOPHER WREN, vice-president, in the chair.

Upon reading the minutes of the meeting of May 30th, a farther discourse was occasioned concerning the revival of several creatures after they had been drowned; as also concerning the reviving of swallows after they had been taken out in clusters from under the ice: concerning which it was affirmed, that SIR GILBERT TALBOT having made particular inquiry into the truth of such relations by special order from the king, he had confirmed those relations.

There

There was read Mr. JAMES YOUNG's account of his observations in several parts of the world concerning the production of springs by the straining of sea-water through the sands and pores of the earth; whereby he endeavoured to prove from several instances, that springs in all places could not have their origin from rain-water, as was supposed, but more probably seemed to be produced by the sweetening of sea-water.

This occasioned a great debate concerning the causes of springs.

Sir JOHN HOSKINS related, that the island of Walkerin was all of clay, and yet at the bottom of the hills there were great numbers of springs of fresh water.

He added, that it was not improbable but that a great quantity of the water flowing from the tops of hills was occasioned by the frequent mists there, when there were none in the valley underneath.

He conceived also, that one cause of the mists on the tops of hills near the sea-side is the passing of the air, which is near the surface of the sea, over the top of the hills; and there by the cold, and the beating against the same, might be condensed into water.

He mentioned also, that it was not improbable, that though there might not be a ^{glazed} pot, that would strain the water from the salt; yet there might be glazed pots of earth, through which it is commonly observed, that the salt would pass through the sides thereof, and stick in the form of salt on the outside.

It was objected by Mr. HOOKE, that though it appeared in a dry form, yet that it passed through by the vehicle of the water, which being evaporated left the salt.

Mr. HENSHAW affirmed, that there was a known way of refining salt-petre by transudation through earthen pots in six hours.

Upon this Dr. CAOUNE mentioned the transudation of water through the coats of the stomach, through which yet the air, which was more subtle, would not pass.

Mr. HOOKE added, that the reason of this is from the congruity of the coats of the stomach to water, and their incongruity to air, of which there had been many experiments shewn to the Society.

He farther added, that there are very different salts; some, that are aerial, and have a congruity with the air, and would therefore easily mingle therewith, and leave the water: and there were other salts, that have a greater congruity
 water

water and other aqueous liquors. And of this nature seem to be volatile or uryinous salts, which are readily taken up by the air, especially if the air be assisted by heat. So that if there were a way of rendering sea-salt so volatile, the salt might be separated by sublimation from the water, as well as the water is now sublimated or distilled from the salt.

Sir CHRISTOPHER WREN mentioned, that possibly there might be a way of separating fresh water from salt water, by suffering it to stand and settle in vessels: for that it had been observed, that the top of the water was very much fresher than the bottom; and that by pouring fresh water upon salt, it would remain a good while fresh at the top before the salt would rise thither.

This was seconded by Mr. HOOKE, who affirmed, that he had upon that principle made several weather-glasses, viz. by posing certain bubbles or bottles of glass sealed up hermetically, so as just to sink in fresh water: and that by this means he had found, that by putting salt into such water, or rather gently pouring water upon salt, and putting in the said poised bubble, the same would not sink to the bottom, but remain suspended in the body of the water, at first pretty near the bottom; but at length it would rise higher, according as the salt more and more dissolved in the water, so as at last to float almost at the very top.

Sir JOHN LOWTHER related, that he had a town upon his estate, which was built upon a place, which was formerly sea; notwithstanding which, upon digging wells in the sand (which is the ground, upon which the town stands) they find very good springs of fresh water at eight yards depth; at which place they come to a gravel: that there are ancient hills, which may be supposed to supply the springs: that the manner of sinking these wells into the sand was this; first they make a kirk of wood or plank of the exact bigness, which they design the walls of the well: then they lay that upon the sand; and upon that design they build a cylindrical wall of bricks two or three feet high: they then dig out the sand from within the said kirk; by which means the kirk and wall sink downwards: then they build the round walls higher, and again undermine the same, till it be again even with the sand; and then raise the walls again and sink the kirk, proceeding in this manner till they have sunk the said kirk to the depth of the spring. He added, that under the said town he had found a coal-mine: that in sinking a well to this coal-mine they found these springs at four fathoms depth, which they endeavoured to keep out; but being not able, they endeavoured to see it from water by engines, and continuing to sink farther till they came to a bed of clay at eight fathoms, they were so overpowered with water, that they were obliged to desist from their proceedings to sink it any farther: but that sinking another well at in the same manner at sixteen yards distance, they found the same sort of ground and clay as in the former, but without the annoyance of springs; the former well of eight fathoms depth having drained this perfectly dry, though it was full sixteen fathoms deep; which was a successful attempt of his own contrary to the opinion of the miners.

Mr. HALL remarked, that it was a known experiment to run or draw off the fresh

fresh water from the top of the salt water in the brine-pits after rain, the same remaining at the top of the brine without mingling therewith.

Dr. CROUNE related an experiment of his own trial, which was, that by putting a crust of bread on the top of salt-water, and pouring fresh water upon it he found, that they remained a long time distinct without mingling one with the other.

Mr. HOOKE supposed, that there might be a kind of precipitation or rather fixation of the salt out of the brine, by the straining through the sand; it finding therein somewhat of such a nature, that might mix with it, after the same manner as oil of tartar doth with oil of vitriol; from the collection of which might be produced a kind of salt perfectly insipid. And to make this the more probable, he related it as a known observation at the salt-urns, that the boiling of the aforesaid brine (which had been made by the evaporation of sea-water by the heat of the sun in the brine-pans) constantly separated from the same (though perfectly clear when put into the square iron boiler) great quantities of pure insipid white sand at the four corners of the said boiler. That the reason of this separation here he supposed to be the avolation of that volatile salt, which kept the said sandy substance dissolved and floating in the brine: that there was such an avolation of volatile salt, he argued from the strong smell of spirit of salt in the boiling-house.

Upon this Sir JOHN LOWTHER related, that in making salt in Lancashire upon the river Wy, they take the sand, and steep it in water; by which means they dissolve a great deal of salt out of the sand; then separating the said water from the sand, they boil it up into salt.

Mr. HENSHAW affirmed, that one might, by some drops of clear oil of tartar put into very clear spring-water, separate a small quantity of stony or earthy matter, sometimes mud, sometimes chalk, sometimes earth and sand.

Dr. CROUNE mentioned the keeping gold suspended in aqua regia, and precipitating it with oil of tartar.

Sir CHRISTOPHER WREN supposed, that sea-water might be made fresh by percolating the pores of sea-plants. To which it was answered, that most of those plants tasted of salt; and that there was not yet known any substance, that would retain the salt, and let the fresh water strain through.

It was suggested, that trials might be made with several substances, to see whether there were any, that would make the water at all fresher.

Dr. CROUNE mentioned the experiment, which had been formerly made by Mr. BOYLE, of making the water rise by filtration to a considerable height above the surface of the water in the vessel.

Upon

Upon which it was desired, that some experiments of that kind might be shewed at the next meeting.

A letter in Latin was produced, written by Dr. E. LEICHTNER to Dr. GREW, secretary of the Society, 'written at Erford, 18th May, 1678': but it being long, the reading of it was referred to the next meeting.

Mr. HOOKE likewise produced a discourse of Mr. JAMES YOUNG of Plymouth, desiring a licence for printing the same; which was referred to another meeting.

Mr. HOOKE mentioned an experiment for examining the gravitation of the air at several heights above the surface of the earth.

June 13. At a meeting of the COUNCIL were present

Mr. HENSHAW, vice-president,

Sir JOHN HOSKYNs,

Mr. HILL,

Sir JOHN LOWTHER,

Mr. HALL.

It was ordered, that Mr. HALL and Mr. HOOKE attend the duke of Norfolk, and intreat him from the Society, that since his grace was then pulling down his house, he would be pleased to suffer the library, which he had bestowed on the Society, to be removed to Gresham-College, where there was a room provided for it; and that they also deliver to the duke the catalogue of that library: And,

That the tiles and timber of Chelsea College be taken down, and secured in some place near the same; and that Mr. HENSHAW be desired to direct some person to go about the pulling it down forthwith.

June 20. At a meeting of the SOCIETY,

Mr. HENSHAW, vice-president, in the chair.

A letter in Latin from Monf. BULLIALDUS to the Society, dated at Paris, 25th May, 1678, N. S., was read, wherein was contained an account of, his observations made of the occultation of Saturn by the moon, 27th February, 1672, after sun-set; together with his calculation thereof from the Philolaic tables, by which he found, that those tables and the heavens differed nineteen minutes; and likewise his calculation of the same by the Rudoline tables, by which he found, that it ought to have been begun then, when by his observation he found it to be quite past; which he ascribed partly to a fourth inequality of the moon, which he conceived not to be yet reduced to a theory; and partly to the discrepancy of the motion of Saturn from the theory of it; which was

^v Letter book, vol. viii, p. 34.

^u Letter-book, vol. viii, p. 42. It is printed in

the Philosoph. Transact. vol. xii. n^o 139. p. 969. for April, May, and June, 1678.

found to be slower than the Rudolfine tables not less than a degree and a half, and in his no less than one third of a degree. He mentioned his design of rectifying those tables as soon as Mr. HEVELIUS should publish his observation (which, he said, would be within a year) if his life should be prolonged, which was already advanced to the seventy-third year.

It was ordered, that this letter should be answered, and the respects and kind acceptance of the Society signified therein; with a communication to him of what astronomical matters had occurred, and their desire, that he would continue his correspondence.

A letter in Latin of Signor FRANCISCO NAZARI to Dr. GREW, dated at Rome, 1st May, 1678, N. S. * was read, wherein he testified his extraordinary respect for the Society, and his earnest desire to be serviceable to it by his correspondence, and sending them an account of whatever should occur relating to philosophy.

A third letter in Latin was read from Monsr. HUYGENS to Dr. GREW, dated at the Hague, 6th June, 1678, N. S. * in answer to the Dr.'s letter, and expressing Monsr. HUYGENS's desire to be informed of the inventions and proceedings of the Society, as he had formerly been by Mr. OLDENBURG, and promising in return to communicate to them whatever he should think worthy of their notice. He added, that he had of late employed some thoughts about improving microscopes; being prompted thereto by the discovery of those animalcules in *femine animalis* made, by one HAMMUS, a student at Leyden, which animalcules he, Monsr. HUYGENS, had often seen.

It was ordered, that care should be taken to answer this letter, and to continue this correspondence with Monsr. HUYGENS.

The minutes of the last meeting being then read gave occasion to discourse farther concerning the nature of the air, and of the vapours raised up into it by heat.

Mr. HENSHAW related the manner of making the experiment of condensing the said vapours out of the air by putting ice and salt into a glass tapered downwards, and ending in a point, and then suspending it in some place, where a considerable current of the air passes by. For by that means the vaporous parts of the air will be condensed by the exceeding great cold of the vessel, and trickling down by the sides will drop into a receiver placed underneath the tapering end a pretty quantity of water in a little time.

This was confirmed by Dr. CROUNE and others.

Mr. HOOKE related an observation of the like nature, which he had made in the year 1665, in a deep well of one Mr. CLARKE near Banstead Downs, of

* Letter book, vol. viii. p. 63.

† Ibid. p. 50.

three hundred foot depth ^{to}: into which having, in the time of a very great frost and exceeding cold wind, which happened about Christmas, let down a bottle with spirit of wine so cooled by the air above, the same, when pulled up again, appeared all covered over with great drops of dew: besides which a great many drops of water were observed to be run off from the bottle into the *scule*, in which it stood: which by him was attributed wholly to the warmth and vapourousness of the air at the bottom of the well and the exceeding coldness of the bottle let down, which condensed the vapours of that air into water.

Mr. HENSHAW and Dr. CROWE mentioned the reaking of well-water in frosty weather, which was attributed to the warmth of the water and coldness of the air.

Mr. HOGGE conceived, that this was occasioned partly by the coldness of the air condensing the steams, which continually rise not only from well-water, but likewise from all other water, when of such a degree of heat; inasmuch that all water exposed to the open air, when kept in such a degree of heat, evaporates such a quantity thereof in the space of an hour, though it scarce becomes visible unless in very cold or very hot weather; in very cold weather by the condensation of the steams into a mist; and in very hot by the playing or dancing of the air, as we commonly call the undulation of the rising vapours over rivers.

This also was partly to be ascribed to the keeping in of the vapours of the water in wells by the air of it; which being once satiated would take up no more vapours into it: whence as soon as this water was exposed to fresh air, that was unsatiated, the vapours were taken up more copiously by it. This sufficiently appeared from the damps of wells.

Against this continual evaporation of the air, Dr. CROWE alleged an experiment of KIRCHER: and Sir JOHN HOSKINS affirmed the same to be mentioned by BEREGARDES in his *Circulus Piscinus*; by which it was evident, that water, though exposed to the air, did not yet evaporate, though kept open for twenty years: which is an argument, that all water does not so evaporate, as was supposed.

To this it was answered, that though there might be such an experiment made and observed, yet that this experiment did not overthrow the former supposition; especially since one necessary circumstance in the making this experiment was, that the neck of the vessel, that contains this water, must be exceedingly long and high, and the hole small, so that little or no change was made of the air next the water; which being once satiated would after that take up no more vapours into it.

Mr. HENSHAW mentioned the way of rectifying spirits and volatile salts by very high bodies and heads; to the top of which the spirits and volatile salts would rise; but the watery and phlegmatic parts would not rise near that height: and that there were some volatile salts, which would rise in a small body sooner and higher than spirit of wine.

See above, vol. ii. p. 69.

Mr.

Mr. HENSHAW mentioned the way of refining salt-petre, by mixing with it alum or a quantity of wood-ashes; by which means the sea-salt, that is sometimes found mixed with salt-petre, is separated from it.

Upon the occasion of Mr. Hooke's desiring a license from the Society for printing an ingenious discourse of Mr. JAMES YOUNG, about the use of oil of turpentine in green wounds, and stopping blood, &c. it was desired, that some experiments might be made at the next meeting in the presence of the Society.

June 27. Mr. HENSHAW, vice-president, in the chair:

Mr. WICKS⁴ brought in and read a paper, delivered to him by some Quakers, concerning the great benefit, that would accrue to the nation by the setting up and encouraging several new manufactures, whereby to keep the poor at work. To which the Society returned for answer, that their address was more proper to the parliament, the matter not properly lying before the Society.

The letters of Mons. HUYGENS, Mons. BULLIALDUS, and Signor NAZARI, read at the last meeting, were delivered to Dr. GREW to answer them against the next meeting.

Sir JOHN HOSKYNs desired, that the correspondence with MALPIGHI might be revived.

The minutes of the last meeting were read; upon which by the bye Mr. HENSHAW mentioned the thickening of wine upon the surrounding it with snow: also the condensing of water on the outside of a glass containing wine and ice. He remarked likewise, that mists were observed to rise more from meadows, that lay near rivers, ponds, &c. than from the rivers themselves.

He farther observed, that the disappearing of ships at sea was often occasioned by the thickness of the air near the surface of the sea, and not by the roundness of the earth altogether: as also, that FRANCISCUS PATRICIUS had observed much the same thing upon the Lago di Coma, where by the thickness of the air near the water the sight of a steeple on the other side of it was often intercepted; which was urged by him as an argument against the roundness of the earth, though, as Mr. HILL observed, very fallaciously.

Mr. HILL remarked, that the hundreds of Essex were much more healthy in a wet and cold year than in a hot and dry one: the reason of which he conceived to be from the more powerful operations of the sun in those hot and dry years, for the drawing up those noxious vapours into the air, which in other years rise not at all, but remain in the ground.

Mr. HENSHAW observed, that the heat of the sun produces a much greater

effect upon the surface of the earth than upon the surface of the sea : and that hence proceeded those land and sea-breezes in hot countries ; the air and vapours over the land being every day more powerfully expanded, and every night more suddenly condensed than over the sea, the earth holds the heat longer, and exhales, when the water has given over.

Mr. HENSHAW add'd, that there was a volatile salt, which being mixed with the highest rectified spirit of wine would notwithstanding rise and sublime from it before the spirit of wine would rise.

These discourses were occasioned by the question concerning the height of vapours above the surface of the waters.

Sir JOHN HOSKYNs remarked, that water in glasses, wherein plants, as mint, &c. had been set to grow, would in time grow muddy and foul.

Mr. HENSHAW suppos'd, that this might be occasioned by the plant's castings forth some excrement into the water ; or else by the plant's straining and sucking away the clearer part, and by its leaving the grosser and more feculent part behind ; or by dissolving some parts of the plant.

Mr. HOOKS then produced a new microscope made after his directions by Mr. CHRISTOPHER COCK, whereby the objects were exceedingly magnified, and yet appeared very clear. This was viewed by most of the members present with great satisfaction ; and the microscope was ordered to be bought of Mr. COCK for the Society's use.

The experiments appointed for the next meeting were the trials upon blood with oil of turpentine, &c.

July 4. Mr. HENSHAW, vice-president, in the chair.

A letter in Latin from Mr. GEORGE HELED to Dr. GREW, dated at Hamburgb, 6th May, 1678*, was read, containing an account of the death of Dr. MARTIN FOCILIUS of that city, and accompanying a printed catalogue of his valuable library, which was to be sold by auction.

A letter in Latin from Signor MALPIGHI to Dr. GREW, dated at Bologna, 21st June, 1678, N. S.† was read, giving notice of his sending to the Society the second part of his anatomy of plants.

A letter likewise from Mr. HEVELIUS to Dr. GREW, dated at Danzick, 18th June, 1678, N. S.‡, was read, in which he inquired, whether four of his letters to Mr. OLDENBURG had been communicated to the Society ; and whether his books sent to that gentleman had been sold ; and he mentioned, that the se-

* Letter-book, vol. viii. p. 55.

† Ibid. p. 49.

‡ Ibid. p. 51.

cond part of his *Machina Calcestris*, viz. lib. 2, 3, and 4, would be published within three months.

Dr. GREW was desired to make an inquiry concerning the state of the account of the books of Mr. HEVLIVUS, left in the hands of Mr. OLDENBURG's administratrix, and to give the Society an account thereof at their next meeting.

A fourth letter was read, written by JACOBUS PIGNIUS to Mr. HOOKE, and dated at Padua, 10th March, 1678^a, wherein he expressed the high respect, which he had for the Royal Society, and his great desire of being known to them. He mentioned likewise his esteem for the English in general, and the favour done him by the English students at Padua, in choosing him their pro-syndic for the present year.

It was ordered, that answers to each of these correspondents should be prepared against the next meeting by the secretaries; and that care should be taken to give a brief account of each letter in the Journal-book, as had been done in the minutes of the 20th of June preceding.

Then the minutes of June 27th were read; which gave occasion of discoursing farther concerning plants growing in glassess filled with water.

Dr. CROUNE supposed, that plants would grow in such glassess, though they had no air, viz. though the ambient air were exhausted.

Mr. HOOKE supposed, that no plant whatsoever would grow in *vacuo*, howsoever ordered: and farther, that they would not grow very long in a glass perfectly stopp'd, though it contained both water and air, provided it had no communication with the outward air to refresh and renew the air: that a plant would be stifled in the manner of an animal, though not altogether so suddenly: but that length of time would make them grow pale, and sick, and die.

Sir JOHN HOSKINS mentioned the way of whitening plants, by burying the stalks and leaves in the earth: as also that plants would wither and die, if they were kept in close air in a house.

Dr. CROUNE affirmed, that plants would grow in water, notwithstanding they were covered and kept from the air.

This occasioned some debate; and it was ordered, that Mr. HUNT should make trial thereof, whether a plant, from which the air was wholly excluded, would grow at all.

It was farther desired, that some other experiments should be made, whether plants would grow in a pent air.

^a Letter-book, vol. viii. p. 32.

Mr. Hooke mentioned an observation, which he had several times made, that some of those plants, which had been set to grow in glasses of water, would after a certain time begin to pine and waste, and at length be all over covered with small insects, which in a short time would all be gone, and leave nothing but their husks behind, sticking all over the surface of the plant; and at the same time also the plant perfectly dead and withered, as if the plant had been nothing else but the nurse or dam of those insects, and that the spirit or life of the plant had flown away in the insects and had only lasted till it had brought forth that living animal offspring. He also mentioned, that he had observed several other things in plants of the like nature, which seemed to hint some such theory.

Dr. PELL hereupon called to mind a certain fungus formerly given by him to the repository, which in a short space was all converted into worms, nothing of the mushroom being left but a little dust.

This was confirmed by Mr. Hooke, who had taken notice of that strange metamorphosis.

Dr. GALE mentioned, that plants would grow, though they were perfectly covered with water so, as no part touched the air.

It was further added, that there are several sorts of sea plants, which grow on the rocks at the bottom of the sea at a good distance from the air.

Nevertheless it was supposed, that the air influences such plants; and that those plants would not grow, if they had not fresh air communicated to them by the water.

Hereupon it was observed, that plants would wither at the bottom of the river after a long drought, though they were still covered with water: that fish would be stiffer in water, if they were not exposed to the fresh air, and often supplied with fresh water.

Dr. Grew mentioned, that it was common for a sort of mushrooms-mould or mother to grow in water close stopped up in bottles.

Mr. HENSHAW mentioned also the observation of moss growing upon the very substance of glass, and seeming to feed upon it, and eat into the very substance of it.

He likewise mentioned the way of making spunk out of brown paper by boiling it in salt-petre.

July 11. Mr. HENSHAW, vice-president, in the chair.

Mr. Hooke gave an account of the trial of an experiment propounded at the last meeting by Dr. CROUNE to be made to see, whether a plant set in a glass

of water will grow *in vacuo*; and he related, that a plant being put into water upon the Tuesday preceding, by Mr. HUNT, and let into the receiver of the air-pump, he had endeavoured to keep the air exhausted ever since by now and then drawing out by pumping what air might have gotten in; and that the plant, which was a blade of mint, was observed to be withered and dead.

Hereupon was occasioned a discourse about the use of air both to animals and vegetables, and what animals were observed to live longest in this evacuated space. And upon this occasion, vipers, bees, snails, &c. were mentioned. But the snail was mentioned as a creature the least sensible of the alteration of the medium. Vipers were mentioned to live long in it, yet to be extremely swollen by the expansion of the air in them.

Mr. HENSHAW gave some instances of the strange stretching quality of their skins; which some of the members desiring to see, Mr. HUNT was ordered to fit the engine, and to procure a viper for trial at the next meeting.

Dr. COX desired, that a tortoise might be also tried, it being a creature, that will live buried in the earth a whole winter without air. Others mentioned snails, slugs, grigs, and bees. And Mr. HUNT was ordered to procure as many as he could against the next meeting.

Dr. COX queried about the slime of eels, whence it should proceed?

Dr. GREW supposed it to be produced by certain glandules under the skin, after the same manner as the glands in the throat eject continually a slime.

Mr. HOOKER supposed it rather to proceed from the transudation of the vapours, or sweat, or rather insensible transpiration the eels; which vapours coming into the water condense and convert that, which is contiguous, into a slimy substance after the same manner as the seeds of *scutellus Christi* put into water condense the water about them into a jelly. And he mentioned, that he had a way of converting slime again into water.

Hereupon it was debated, whether the skin has distinct pores or not. Dr. GREW was of opinion, that it has distinct pores; which he said he could make visible; that they were placed after the form of spherical triangles; and that he could see the sweat issue out of them.

Mr. HOOKER supposed the skin to have no distinct pores, but defined or rather described the skin to be a body consisting of two sorts of substances, the one solid, the other fluid: the solid part a close texture of infinite small fibres every way interwoven like the hairs of wool in a piece of cloth or felt. And this is the reason of the great aptness, which it had for stretching and shrinking any way; as may be also observed in a loosely woven piece of cloth.

July 9.

The

The other part is a fluid, which fills the interstices of all these contexted fibres. The fluid is compounded of a more gummy substance and a more watery. The watery part is that, which coming to the outside of the skin is exhaled into the air; by which means the gummy part are thicker next the air than elsewhere; and if the cuticula be either by fire or other accidental cause thickened too much to hinder the watery part from mixing, and propelling through it, the watery part will gather behind it into a body, and make blisters; or otherwise throw it off in scurf.

The discourse of eels produced another about fish living upon very little food. Dr. Cox affirmed, that he had kept a craw-fish in a cistern of lead, without any other food than the water, where it had increased and grown much bigger.

Sir JOHN HOSKYNs remarked, that it was usual to feed craw-fish; but that there were some rivers, in which craw-fish would thrive better than in others; mentioning two rivulets in Ouseworth in Gloucestershire, which ran both into one, at that place. The one had the pebbles spotted with red, the other not. In the former of these both trout and craw-fish were found in great plenty; but in the other neither.

Dr. Cox affirmed, that craw-fish delighted in the shallow and gravelly parts of rivers.

Dr. HOLDER mentioned, that eels in Ely River were commonly made bigger and sweeter, and fed fatter only by being kept in a box with holes, and hung in to the Thames, without giving them any other food.

Mr. HENSHAW conjectured, that it might proceed from the fatness of the Thames water, which would yield a burning spirit after fermentation, as had been often found in sea-voyages.

Other fishes were named, which were supposed to live upon a very small quantity of food.

Dr. Cox mentioned the whale, which affords the sperma ceti; that though it has a vast mouth and tongue, yet it has an exceedingly small gula; and nothing is usually found in its maw but some small quantity of sea-weed or alga.

Mr. HENSHAW remarked, that there are great variety of whales; and that the sperma ceti whale is not found in the northern seas.

Mr. HILL took notice, that the anatomy and description of that whale is to be found at the end of Sir THOMAS BROWN's discourse on *Vulgar Errors*.

Dr. Cox mentioned, that he had observed, that in a scarlet fever the cuticula would peel and fall off much like the casting of the skin of some animals. Here-

Hereupon Mr. HILL affirmed, that Dl of the Goa Stone being given to a child sick of a fever presently recovered the said child; but caused all his cuticula to grow hard like horn and peel off.

Query, whether it were the *pie dra de cobra*?

Hereupon Dr. DANIEL COX mentioned the strange virtue of the ophites or snake-stone in adhering to any inflamed part during the inflammation, and not falling off till the inflammation be allayed; and that he had seen this tried successfully on a child the week before.

He related, that there was a certain herb, which being held in the hand only would cause a bleeding at the nose to any quantity, forcing the efflux of blood to long, as the said herb was kept in the hand.

Mr. HILL mentioned a certain bone, which held in the hand would presently stop bleeding.

Mr. HENSHAW related, that there was a certain Irish plant, called by the Irish *macambay*, which being held in the hand only would provoke purging: This account was confirmed by others.

Dr. DANIEL COX related, that there was lately brought from Carolina in America a certain powder, which being ordered duly made a drink, called by the natives *Cassini*, which strangely exhilarated those, who drank it, and freed them from troublesome fevers for twenty-four or thirty hours after: but that then they more funk. He described the manner of preparing this drink; but promising to bring some of it to the Society at their next meeting, and to shew the manner of making, the description thereof was omitted in the minutes of the present meeting.

Upon this the strange qualities of the herb *deutroa* were mentioned: as also those of some other plants.

Dr. DANIEL COX related, that there was another snake-weed discovered, which was an infallible cure for the biting and poison of rattle-snakes.

Mr. AUBREY related, that there was an herb called *terrarā*, brought over by Sir PETER COLLETON from Carolina, and that the same grew here in Mr. JOHNSON'S garden; which herb was esteemed the best antidote against all manner of poisons, the virtue of it being kept amongst the Indians as a great secret: but that it was procured by one, who married an Indian king's daughter. This was said to be mentioned in the history of the Antilles, and called *herbe aux fleches*.

Mr. HENSHAW remarked, that GARCILASSO de la VEGA in his history of Peru mentions how they make their poison for poisoning their arrows and darts, viz. by sticking them into human flesh hung up till it be rotten and putrified.

He also gave an account of a boy, who thrusting his thumb into the corrupte^d flesh of one executed, was like to have lost his arm by a gangrene.

He also took notice of the strange effects related of the poisoned arrows of archin; which by touching the blood without the skin would presently turn it yellow; and this yellowness would spread; and if it got within the wound, would kill the person: by which it was known whether the poison was right.

Mr. AUBREY related, that dogs licking the fanies of one hanged in chains near Kennington were poisoned and died; and that a man wearing the shoes, which had been taken off a malefactor's feet after he was rotten, had his feet rotted off.

Mr. HENSHAW related, that there was an arbutus, called in Spanish *madrones*, which was of the nature of deutroa; the fruit of which would make those, who eat it, as it were mad or drunk for a time; and that the continuing to eat it would in time make them sottish and fools.

Dr. DANIEL COX related, that BACON, who at his first going into America, had been very curious in making observations on animals as well as plants, had given to him a description of certain animals, that were found in a very large plain or champaign country, lying between Hudson's Bay and California, in vast numbers or herds. These at a certain time of the year shed their wool or coats, in which was a very fine fur or wool; and the wind blowing gathered it together into great heaps or cakes. These were supposed by Mr. HENSHAW to be a sort of Indian goats, called by the Spaniards *vacuncos* or *guercanades*, and were described by De LAET. He added, that he was confident, that there was no north-west passage; and that he could demonstrate that Hudson's Bay and the South Sea were a thousand miles distant.

Dr. DANIEL COX related an experiment and observation of his made upon snow-water, viz. that evaporating or boiling away about forty or fifty gallons to one, he found it of a lixivial colour. This he let stand for some months; after which the liquor began to shoot into *striae*, which stuck all about the insides of the glass in the form of stars, with many points of a greyish colour, though the snow was very pure. This, though in the form of a salt, was not salt, but a kind of a fibrous substance. He remarked also, that nitre received from spirit of nitre and alkali will shoot into hollow hexedrical figures more curious than common nitre, and form also stars of six points.

DAVID HANNISIUS, library-keeper to the duke of Hanover, and JOHN VANDE BEMDE, Esq; were proposed as candidates by Mr. HAAR.

Dr. GREW produced, as received from Mr. GEORGE HELD of Hamburg, a catalogue of the library of Dr. FOCULUS of that city; together with a printed sheet, intitled, *Programma in funere nobilissimi viri D. Martini Pegelii, Phil. Med. Dett. & P. P. in Gymnasio Hamburgensi.*

July.

July 18. Mr. HENSHAW, vice-president, in the chair.

An experiment was shewn, of putting an eel into the exhausting engine ; which being made staunch, the animal presently died.

Upon discoursing about the food of fishes, Dr. CROWE related, that fishmongers never find any thing in the maws of salmon. And that a lady, who had been very inquisitive in that kind, had observed the same : but that the contrary was observed in most other fish.

Dr. GREW remarked, that the guts in salmon placed round the stomach answering the *intestinum caecum* in other animals were very full, though the stomach were empty.

Sir JOHN HOSKYNs related, that there was one sort of whale towards the north, that was reported to feed upon flies ; vast quantities of which had been found in the stomachs of those whales : and that their fins seemed to serve for the straining of the flies from the water.

Mr. HOOKE gave an account of the structure of the mouth and fins of that whale, which was cast on shore at Greenwich about twenty years before.

He also mentioned a late relation, which he had seen printed in Low Dutch, or a voyage to Spitzbergen or Greenland, wherein was a description of that sort of whale, together with pictures of them.

Mr. HENSHAW affirmed, that salmon feed upon flies.

The bishop of Chester * remarked, that he had a dish of fish, which had been taken very whole out of the maw of a large fish ; that they eat very well ; and that they were a sort of flounders.

A discourse was then occasioned about poisons.

The bishop of Chester related, that Dr. HARVEY was of opinion, that a man might be saved, though shot with a poisoned dart, if a very strong ligature were made above the wound immediately, and the mortified part below the ligature were cut off presently. But it was thought by others, that this means would not be effectual, if at least the poison were so violent as was reported, unless a ligature were made before the person was wounded by the dart.

Sir ROBERT SOUTHWELL mentioned the trial of the Florentine experiment, viz. that of oil of tobacco, the black heavy oil, that sinks to the bottom in distillation, upon a chicken, related by Sir JOHN FINCH ; of which the Society had before where an account, and had formerly made many trials.

Sir JOHN HOSKYNs related, that a good quantity of fair water was the best antidote to this poison of tobacco oil.

Dr. CROWE related, that he had been informed of an English merchant, who had been told by the present king of Macassar, that neither himself nor his father knew any thing concerning such poisons, as they were related to know: but that he had been told, that his grand-father knew much of poisons.

Dr. HOLDER related, that he had known the oil of tobacco made by blowing the smoke upon one's nail, or a knife, being put upon lint, and stopped into the hollow of a rotten tooth, to cure the tooth-ach.

Mr. HOOKE remarked, that Sir CHRISTOPHER WREN had formerly told him, that he knew a maid-servant by the use of that medicine cast into convulsions, which had like to have cost her her life.

Dr. CROWE related, that he had been informed by Mr. WHITECHURCH, who had lived some time in India, that mountebanks * * *

Sir ROBERT SOUTHWELL observed, that he had been informed, that the best remedy against poisoned arrows was presently to eat human excrements.

Mr. HOOKE mentioned the odd effects, that were wrought upon the children of a poor woman, who used to gather physical herbs for Mr. DRINKWATER, by eating some henbane, which they had mistaken for parsnips: that they all fell stark-mad, but were cured in some short time by the said Mr. DRINKWATER, by the taking of alexipharmics and sweating.

CHARLES STEWART, Esq; son of Sir NICHOLAS STEWART, was proposed candidate by Dr. HOLDER.

Upon occasion of a discourse, which was about the breadth of the north part of America, and of the nearness of the South Sea to Hudson's Bay, Sir ROBERT SOUTHWELL remarked, that in Sir WALTER RALEGH's time it was thought, that the South Sea was not above forty or fifty miles from the North Sea: and that he had seen it so described in a map; which was the reason, that in the patent of Virginia the king had granted the country from sea to sea.

July 25. Mr. HENSHAW, vice-president, in the chair.

Dr. GREW read several Latin letters, which he had prepared for answers to correspondents.

The first was to Mr. HEVELIUS, in answer to a late letter of that gentleman, desiring to be informed of the state of the account between him and Mr. OLDEN-

* This minute was not completed:

BURG deceased, with relation to some books of the former sent over to the latter.

The second to Signor MALPIGHI, about the expectation of the Society of his farther discourse on vegetables :

The third to Monf. HUYGENS :

The fourth to Monf. SLUSIUS :

The fifth to Monf. BULLIALDUS :

The sixth to Signor NAZARI : and

The seventh to Mr. HELD of Hamburgh.

It was ordered, that Mr. WICKS should make copies of all these letters in the Letter-book *.

A letter from Monf. LEIBNITZ, dated at Hanover, was read ; and Dr. GREW was ordered to prepare an answer to it against the next meeting.

Sir JONAS MOORE read part of a letter of Mr. TOWNLEY, sent to him from Paris, containing an account of what BORELLI was doing, in order to the improving of telescopical object-glasses : as also about several new experiments of changing colours by transparent liquors : of Dr. TABOR's success in curing agues : and of the death of Monf. DE CHALES, the author of the *Cursus Mathematicus*.

The minutes of the last meeting were then read ; whereupon by the way Mr. HILL mentioned, that he had been informed by a fishmonger, that he had found the stomach and guts of a salmon full of grass, and of another full of fish-bones.

The vice-president, upon the mention of whales, remarked, that there were reckoned by some authors near fifty sorts of the cetaceous kind.

Upon occasion of a discourse about poisons, Mr. HOOKE mentioned an account, which he had from a Virginia merchant, who had lived long in those parts, and had been very curious and inquisitive into all sorts of natural curiosities ; that the only certain cure of the venom of the biting of a rattle-snake was a certain substance found in the wild walnut-tree, called by the planters the hilcanes-tree, being a kind of spunk, but called by the planters punk. It grows within the body of the tree, and is found by a kind of black hole or navel in the tree ; which the planters observing, they presently cut down the tree, and take out the said substance, and preserve it with very great care, being of so sovereign a virtue, besides

* They do not appear in that book.
p. 1005. for July and August, 1678.

" See Philosophical Transactions, vol. xii. n^o 140.

its other uses for kindling fire, which it catches most readily. The way of using it is thus: as soon as a person finds himself bitten, he immediately takes his flint and steel, and some of this punk, which he always carries about him; and kindles it, and applies the burning punk to the place bitten; and there keeps it burning till he feels the fire (which he will not presently do, because the part bitten will immediately after grow mortified and senseless;) and thus he continues it as long as he can endure it: which will certainly cure him without any other after-symptoms; which if the remedy be not presently applied, are very terrible, and often fatal. In confirmation of which last circumstance, the same person had informed Mr. Hooke, that he knew a man, who had been bitten by one of those rattle-snakes in his finger whilst he was hunting a hare in the woods, having thrust his hand into a hollow tree, where by the baying of his dog he supposed that a hare had sheltered itself. He being bitten, immediately found his hand and arm extremely swollen, with great pain; and then the whole wood seemed to him to turn round; and presently after to be all in a flame: upon which he fell down, and remembered nothing farther. Being within a short space of time after found by some of his friends by means of his dog, he was carried home on a ladder senseless, and by means of a chirurgeon not far distant was so ordered, that he recovered without the loss of his life; but it was three quarters of a year before he was well, and he lost his hair and nails, and his skin peeled off, with many other dreadful symptoms.

Mr. Hooke mentioned likewise, that he had been informed by Mr. HODGES of Moorfields, that he had known a man, who had cured himself of the pain and swelling of the gout, by applying upon the place quick lime-stones, while they were sticking.

Mr. Hooke, upon this occasion of the growing of the spunk within the body of a tree, said, that it seemed somewhat to resemble the rot in a tooth, which he had observed to have a certain black substance, which covered the surface of the hollowness thereof, which began generally from a small hole in the outside thereof, and so spread itself like a mushroom into the more spongy substance within the outward hard crust.

Mr. HINESHAW supposed it to be rather a worm, which having corroded the outward crust continued to corrode the inside thereof: and in confirmation of this he added, that he had seen a woman extract worms from a hollow tooth by the help of a sharpened quill.

Others mentioned, that the same thing was done by the help of the fumes of henbane seeds taken into the mouth; whereby the saliva falling into a basin of water held underneath, would discover several living worms, supposed to issue either from the gums or teeth.

Mr. MILLING produced a small worm, which he had found in New River water, about six inches long, of the bigness of a horse-hair. It was viewed by
2 several

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several small single microscopes of his own making, and found to be alive, and to have a head somewhat like an eel.

August 1. The president, Sir JOSEPH WILLIAMSON, in the chair.

Dr. GREW read an answer to Monf. LEIBNITZ; which answer was ordered to be copied by Mr. WICKS into the letter book.

Mr. HOOKE read the minutes of the last meeting; and then produced a piece of punk given him by the Virginia merchant, who had acquainted him with the former relation and description of it. It was a very light spongy substance, and seemed to be no other than the substance of a fungus or mulhroom. The colour of it was brown; and it readily took fire, and would continue to burn till the fire was stifled, but seemed not to burn very fiercely.

Upon this occasion mention was made of the moxa of the East Indies, which cures the gout by the application of it burning to the part affected; and which seemed also to be a kind of spunk.

Sir CHRISTOPHER WREN remarked, that it was probable, that the cures of both might be effected by the heat of the fire, and not by any peculiar virtue in either the moxa or the spunk.

Another member supposed, that it was the heat also of the limestone, which had effected the cure of the gout mentioned in the minutes of the last meeting.

Some mention was likewise made of cures done by the natural heat of living bodies outwardly applied.

Sir CHRISTOPHER WREN observed, that the raising of a blister would cure the ringing of wassja.

It was also added, that the head of a red-hot iron would cure the biting of adders: and that there was a man, who sold adders, who had several times shewn the experiment, and would at any time do so to those, who were curious, for a reward in money.

Mr. HOOKE read a discourse of his, concerning the nature and power of springs and electrical bodies, giving not only an account of the nature and power of all sorts of springy bodies, and the several phenomena thereof, but likewise of the reasons and grounds of those phenomena; as would more at large appear in the discourse itself, which he designed speedily to publish.

* It is not inserted there.

* It was published at London, 1678, in 4to. under the title of *Lectura de potentia resistendi*

of springs, explaining the nature of springing bodies.

He

He then exhibited two experiments in order to prove his said theory; the one with a tubical spring of brass-wire, and the other with a spiral spring of steel, being the spring of a watch.

Mr. MELLING produced the hair-worm, which he had shewn at the last meeting, now preserved in spirit of wine in a cylindrical glass-pipe hermetically sealed, it having since died; wherein the head of it was plainly to be seen by the help of his small single microscope.

August 22. Mr. HENSHAW, vice-president, in the chair.

Mr. HOOKE delivered to the Society an antient urn of glass, taken up in Spittlefields upon digging cellars there, presented by Sir CHRISTOPHER WREN for their repository. There was this remarkable in it, that it seemed to be made after quite another manner than that used by the present workmen in that art, it having no place at the bottom thereof; nor any visible sign how it could be held, whilst the lip and handle thereof were joined to the body.

Mr. HOOKE shewed the experiment of the springing of a string of brass-wire, about thirty-six or thirty-seven feet long, extended by weights hung at the lower end thereof; and he made it evident, that the said string extended proportionably to the weight, that was hung to it at the bottom: that is, that one weight extended it one length, two extended it two, and three extended it three spaces or lengths.

At this meeting were present Mons^r EZEKIEL SPANHEIM, envoy from the elector Palatine, and his brother FREDERIC, professor of divinity at Leyden.

After the exhibiting of Mr. HOOKE's experiment, Sir ROBERT REDDING addressed himself to the vice-president and the rest of the Society present, acquainting them, that his grace the duke of Norfolk had desired him to

Mr. HOOKE then shewed to the envoy SPANHEIM and his brother, the small animals discovered in pepper-water by the help of a microscope.

August 29. The president in the chair.

His grace the duke of Norfolk being present at this meeting, renewed the declaration of his gift formerly made to the Society of the Arundelian library; and also gave his consent and direction for the removal thereof into the possession of the Society: and that they should have liberty to exchange such books thereof, as were duplicates, or which they should think not so proper for their use, for others of equal value, which they should judge more pertinent to their design. He declared likewise, that the books formerly reserved by him concerning heraldry were the only books, which he still excepted out of the said donation, having

* The rest of this minute is not entered in the Journal-book, vol. vi p. 124.

made a promise of them to the college of heralds. His grace added, that Sir WILLIAM DUGDALE had presented him with a catalogue of such books, as he in the name of the heralds had desired for that purpose. But upon perusal of the same finding many of them to be such, as did not so properly belong to the business of heraldry, the duke was desirous, that Sir ROBERT REDDING and Mr. EVELYN would peruse the said catalogue, and consider what books therein mentioned were such, as concerned heraldry, and were most proper for the use of the college of heralds, and what might be more proper for the use of the Society, and to moderate and adjudge the matter between the said Society and college. But it was his grace's farther pleasure and desire, that in case the Society should be dissolved, (which it was his desire and hope they never would be) the said library might revert to his heirs.

The Society by the mouth of the president returned his grace their most humble and hearty thanks for this his truly noble present: and ordered Mr. HOOKE to take care, that the determination of the matter between them and the college of heralds might be made with all convenient speed; and that thereupon the books should be forthwith removed to Gresham College.

Mr. HENSHAW moved, that a fair catalogue of them might be made, to be delivered to the duke to remain in his grace's custody:

As also, that all such books, as should be received in exchange for others of the said library, should have his grace's name stamped upon them, and kept with the rest, and to be owned to be his grace's present.

Mr. HOOKE produced and read the preface of a book, which he had procured to be translated out of High Dutch, containing a description and natural history of Spitsbergen or Greenland, written by one . . . of Hamburg, who had been there himself, and upon occasion of queries sent out of England, had made it his business to inform himself more particularly concerning all matters therein desired; and by the help of Dr. FOCALTIUS of Hamburg, who had translated and delivered those queries to him, had compiled and methodised the same; and for the better illustration of all particulars, had added a great many copper cuts, containing the pictures of the most remarkable particulars, viz. of the whales and other fishes, together with those of the animals, birds, plants, &c. Mr. HOOKE added, that he had delivered the said book to a German, in order to have it translated into English.

Sir ROBERT SOUTHWELL hereupon observed, that there was a kind of whale in the oil of which was so penetrating, that it was very difficult to find vessels to hold it without leaking.

He mentioned also an experiment made upon a square plate of glass, upon which a thing was stretched to a certain tone, which tone upon the application of heat was altered.

The duke of Norfolk mentioned, that the earl of Aylebury had heard his child make a noise whilst in his lady's womb.

Sir ROBERT SOUTHWELL mentioned a relation of a woman of Lorraine, who having been a very long time with child without being delivered, had in despair killed herself. Whereupon being opened, it was found, that the child within her had been dead for a considerable time; and that one part of the body of the said child was found petrified by the waters in her womb.

Upon occasion of a discourse on freezing, Mr. HENSHAW mentioned, that upon freezing of wine, the part, which remained in the middle, would be very strong and spirituous; but that the other parts, that were frozen, would be watrish and almost tasteless: and that the greatest part of the wine froze and swelled out of the bottles, thrusting out the cork before it.

Dr. CROUNE mentioned, that the time of freezing was almost instantaneous.

Mr. HOOKE related the experiment of producing the regular figures by freezing, by mixing snow and salt in the body of a glass vial, and then putting upon the outside of the same a small quantity of the spirit of urine.

Mr. HOOKE was ordered to make what haste he could with the weather-cock, which he designed; as also with a very accurate barometer.

October 31. The Society met again after their adjournment, and Mr. HENSHAW, the vice-president, took the chair.

The minutes of the last meeting were read; which gave occasion to some discourse concerning the petrification of human substances.

Dr. CROUNE mentioned that there had lately been a discourse on that subject published by * * *; and that it had been answered by * * *.

Mr. HENSHAW mentioned, that he had seen the arm of a man petrified at the house of cardinal MONTALTO, called *Villa Peretti*, it being part of the body of a man wholly petrified in the Alps.

Upon reading the remark concerning freezing, Mr. HENSHAW added, that having in Denmark set brandy to freeze in cups, he found, that all the spirituous part thereof was partly wasted, and partly converted into a spongy ice, of a very ill taste; and that it had lost all its strength.

Sir JOHN HOSKYNs related, that Dr. MERRET had assured him, that the strongest wine might be all frozen in the Florentine flasks: the reason of which was conceived to be the extreme thinness of them.

Mr. HOOKE read a letter directed to the two secretaries from Mr. MICHAEL BUTTER-

BUTTERFIELD, a mathematical instrument-maker at Paris, dated there, 7th October, 1678¹, expressing his desire to correspond with them concerning philosophical, mathematical, and mechanical matters; and offering to communicate such things, as he should meet with there of that kind. He mentioned in that letter Mons. HUYGENS's method of making small globules of glass for microscopes, by sticking powdered glass on the point of a needle with spittle, and holding them in the flame of a lamp of spirit of wine, and afterwards rubbing them with a putty cloth: as likewise a level of his own invention, published the year before in the *Journal des Savans*, together with a farther improvement of it by hanging it upon one point.

He took notice also of some other sorts of levels invented by other considerable persons: and added, that he was making a large silver planisphere for the king of the invention of Signor CASSINI, of two feet diameter: that he had lately made for Signor CASSINI an equinoctial dial of a foot diameter, with three circles, besides the sliding ring, and two halicircles and four sights: that there had been lately made at Paris a piece of clock-work to shew the motion of Jupiter's satellites: but that it was not much approved of: and that himself had not long before made a sliding half quadrant, with a glass of eight inches semi-diameter, of very great use, and easy to be carried.

In this letter were inclosed two packets, one from Mons. GALLEY, provost of the church of St SYMPHORIEN at Avignon, containing a letter in Latin to the Society: and three small tracts; the first his account of the observation of Mercury in the sun; the second his observation of an eclipse of the moon, 17th May, 1677²; the third his observation of an eclipse of the sun 11th June, 1678; all three observations made at Avignon.

Mons. GALLEY's letter was read, wherein after professing his great respect for the Society, he added his desire of holding a correspondence with them upon astronomical subjects, and promised to send such other observations, as he had hitherto made, and not yet published, and especially those about the diameters of the sun and moon, concerning which he gave some instances relating to the sun's diameters.

Dr. CRAVINE affirmed, that Mr. ROOKE had long before used the same way, for taking the diameters of the sun, with that made use of by Mons. GALLEY, viz. by computing the time of the transit of its figure made by a forty foot glass.

Mr. HOOKE read a relation of a great eruption of fire, which happened in the preceding winter in the isle of Palma, one of the Canaries, given him by a person, who had long resided in the said island, and who was there at the time of the said eruption.

Mr. HENSHAW was of opinion, that hot baths were caused by subterraneous
¹ Letter-book, vol. viii. p. 59.
² Letter-book, vol. viii. p. 27.
 the Philosoph. Transact. vol. xii. n^o 141. p. 1026.

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fire.

fire, because generally where there are subterraneous fires, there are many hot baths.

Sir PETER WYCHE acquainted the Society, that he was very speedily to go to reside at Hamburg, and professed his desire and readiness to promote the interest and business of the Society in those parts.

Mr. DETHLEVS CLUVERUS was proposed candidate by Mr. HAAK; and Mr. WILLIAM PERRY by Dr. MAPLETOFT.

November 7. Mr. HENSHAW, vice-president, in the chair.

The minutes of the last meeting being read, occasion was given of discoursing of cold and freezing; and Mr. HENSHAW affirmed, that by experience he had found, that the coldest weather in Denmark would not freeze a whole bottle of sack.

Mr. HOOKE shewed the planisphere and description of the stars of the southern hemisphere made by Mr. HALLEY. Whereupon Mr. HENSHAW was of opinion, that they would be very acceptable presents to such correspondents abroad, as were lovers of astronomical matters, if the book and planisphere were sent to some of them from the Society: to which the Society agreed; and it was desired, that the secretaries should send one of these books to Monsr. GALLET, another to Mr. BUTTERFIELD, and a third to the Abbé de la ROCHE, in the name and at the charge of the Society.

Upon a further discourse concerning hot baths, Mr. HENSHAW was of opinion, that they might proceed from some subterraneous fire, because they are generally found near such places, where those subterraneous fires break out, as in Iceland, and one about Naples especially. And whereas it was urged, that they appeared many times in places, that were far enough from such burning mountains; he answered, that though there might be no appearance of fire, yet there might be some subterraneous fires concealed, that might be the cause of such heat. Dr. CROWE objected, that such could scarce be supposed without having certain *spiracula* or breathing places near them; none of which being found near our baths, it was difficult to suppose, that there should be any such fire. It was added, that it was possible, that there might be such *spiracula*, which we know not of; at least we do not know what space the subterraneous fire might possess; whether it might not spread some miles besides just underneath the place, where the hollow fountains are; and whether there might not be subterraneous communications between volcano's at a great distance. Mr. HENSHAW added farther, that there were some hundred of such volcano's in the East and West Indies. Sir JOHN HOSKINS subjoined, that the Dutch had noted about an hundred in their plantations.

Mr. HOOKE remarked, that it was very common to observe a mist hanging about the tops of hills, when the air above, beneath, and round about was clear.

* M. A. and fellow of Trinity College, Cambridge.

It also conceived, that there was no earthquake without a subterraneous fire; and that many of those subterraneous fires proceeded from parts very deep in the very body of the earth, and not only near the surface, like the coal mines in the north, which had been set on fire, and had continued so for many years.

Dr. MAPLETOFT affirmed, that he had seen a coal-mine, which had so burned and said, that it was very shallow, and but a very little way, viz. about a fathom or two, below the surface: that it was not difficult to quench it: that it burnt very slowly forward: that he had also seen the burning fountain in Lancashire near Wigan, and conceived it to be an exhalation arising from some coal-mine underneath.

Hereupon a discourse was occasioned, concerning the cause of the generation of subterraneous fires, and how they should be continued without immediate communication with the air.

Mr. HOOKER mentioned some observations about the generation of fire by rain falling suddenly on a sort of coals, called brash lumps; as also on quick-lime lying against deal-timber; both which had caused fire. Mr. HENSHAW, Mr. PACKER, and Dr. CROUNE instanced in other substances, that would generate an actual fire, such as hay wet, green grass heaped up, malt, cotton-wool, rose flower leaves, and several other green leaves and plants.

Upon a discourse concerning the well dug in the island of Mayo, Mr. HENSHAW was of opinion, that no fresh-water could be separated from salt-water by straining or any filtration; though mention was made of the cups of ivy, which, it was said, would make some such kind of separation, viz. that upon mixing wine and water together in one of them, it would suffer the water to run through, but would stop the wine; which was thought to be the reason, why it was sacred to Bacchus; though others supposed, that it might be from its use at the Bacchanalia for crowning the actors.

It was desired, that one of those cups might be provided against the next meeting, to see what might be effected thereby, and whether any thing extraordinary in filtration might be hoped from it.

November 14. Mr. HENSHAW, vice-president, in the chair.

Dr. CROUNE acquainted the Society, that the president had given him an account, that he had received from Signor MALPIGHI a piece of a plant, together with an account thereof, that he had thereby found out and demonstrated the circulation of the juices of plants.

The vice-president propounded the five following members, viz. Sir JOHN LAURENCE, Dr. CROUNE, Dr. PLOT, Dr. GALE, and Mr. GEORGE ENT, who were accordingly chosen by ballot, to be a committee of the Society for auditing the treasurer's accounts for the preceding year since the last St. Andrew's day.

Upon a discourse concerning Bezoar stones, that vast multitudes of them were brought over into England, and that therefore many of them were probably counterfeit, since even in India and the places, where they were found, they were very scarce, and seldom found in those goats, which produced them; Mr. COLWALL related, that there were many of them counterfeits; and that he had tried them by means of a needle heated red-hot; for upon thrusting into them a needle so heated, those, which were counterfeits, would melt and fry; whereas those, which were true, would not.

Hereupon was occasioned a discourse concerning the balls, which are often found in the stomachs of oxen; some of which are found covered with a calculous matter, after the manner of Bezoar stones; others only a great ball of hair very hard, and closely felted together, in a very regular order.

Mr. Hooke related, that he had often taken the hair of oxen, when they had their coats, and rolling a handful or two of the said hair between his hands, had thereby in a very little time felted them into a very hard and close ball; and that the hairs thereof would naturally range themselves into a most regular and uniform order.

Upon the discourse concerning the eruption, which had lately happened in the isle of Palma, and the river of fire, which ran down from the same, Dr. CROUSE related from Dr. PUCH, that the north side of the Pike of Teneriffe was made up of a matter, which plainly manifested it to have been such a fiery river; it being all melted stones and minerals of that nature: which agreed exactly with the relation lately read at the Society.

Hereupon the burning fountain in Lancashire was mentioned; and Mr. HUNT said, that he had been at the place; and that it would take fire by driving down a stake into the ground, and wriggling it to and fro.

Upon discoursing concerning the actual burning of several places under the ground continually, such as the coal-mines and the burning mountains; Mr. HENSHAW related, that he had been at the Solfaterra in Italy, which lies between two mountains, where he had observed the fire to break out in many places; and that the earth would shake underneath them, and seemed to be all hollow and burning underneath the place where they walked, and had continued so for many ages.

Sir JOHN LOWTHER affirmed; that he had a coal-mine of his own, which was on fire; but it not lying very deep, he had put out the same by digging a deep trench in the ground round about it under ground.

He promised to procure the account of a coal-mine of Sir WILLIAM BLACKET.

The experiment of filtration through a cup of ivy was tried; but it proving so close,

clock, that nothing would filtre or pass through it, Mr. HUNT was ordered to procure another cup of ivy against the next meeting.

Upon occasion of the discourse concerning the *lupus marinus*, the teeth of which ~~sm~~ were supposed to be the toad-stones, Dr. FLOT related, that he had a toad-stone, which was not such a tooth, but a real stone, which he had himself found in Oxfordshire. But this was a softer stone, and would not polish as the other stone.

Dr. KING, upon occasion of discoursing of pearls and bezoar-stones related, that he had often found pearls in the stomach of an oyster; and conceived them to be generated as the bezoar-stones in the stomach of a goat.

Hereupon Mr. HENSHAW mentioned the way of cleansing pearls, by dipping a foul pearl in aquafortis or spirit of wine; by which means the pearls would presently look white; and then by rubbing it with a cloth all that white coat would come off, and the pearl underneath, if good, would look oriental and clear: but that by often repeating that operation all the shining part of the pearl might by degrees be taken off; and that usually all foul pearls had in the middle of them an opaque calculeous matter.

He related also the way of making counterfeit pearls used at Bologna and Venice, by silvering or gilding alabaster beads, and dipping them in a lize made of fish glew.

Mr. HOOKE related, that he had done the same thing here, by taking ivory beads instead of alabaster, and proceeding in the manner above-mentioned.

He shewed his experiments, which were divers ways of making very round and clear Globules of glass for microscopes with great care.

November 21. Mr. HENSHAW, vice-president, in the chair.

He produced three pieces of stones or different substances; but all agreeing in this, that they were made of several sorts of small pebbles, which were cemented together by a petrified substance as hard as the pebbles themselves. They seemed to be of the same kind with some produced at the same time cut in pieces of knives, and polished very well; which seemed as good as, if not to exceed, the Indian agates. Mr. HENSHAW resolved to have them cut and polished in the like manner, and promised then to shew them again to the Society; adding, that he knew where a very great quantity of the same stone might be procured, if there were occasion, viz. in Hertfordshire, not far beyond St. Alban's.

A note signed by Sir JONAS MOORE, vice-president, was directed and ordered to be sent to the porter of Arundel House, to deliver to the bearer Mr. HUNT the eleven books, which were left in the library of Arundel House now pulled down.

Upon a farther discourse concerning bezoar stones, mention was made of a passage

sage in Dr. PRIMROSE's book *De Erroribus Vulgi*, that pope SIXTUS QUINTUS had almost a cart-load of bezoar-stones sent him; but that upon the examination of them by skilful physicians, not above three of them proved very good; most of the rest being sophisticated.

Dr. CROUNE added, that the Indians found sometimes a sort of bezoar-stones in the maws of monkeys, which they valued at so high a rate, as to esteem them a fit present for the Great Mogul himself.

Mr. HENSHAW remarked, that there was mention made in LINSCHOTEN's voyages of another sort of stones somewhat of the nature of bezoar, and esteemed every way as good, which are found in the stomach of a porcupine, and thence called by the Portuguese *pedra de porco*; which are smaller, generally about the bigness of a gall, and of a dark brown colour. They are frequently made use of in feverish distempers, and have been used with good success for the strengthening the stomach. Being steeped some few hours in fair water, they yield a greenish tincture, which tasteth very bitter.

Hereupon mention was made also of a stone presented to Sir ROBERT SOUTHWELL, called *pedra de cobra*, being one kind of snake-stones, which was supposed to do great cures by outward application for the biting of serpents. It is a fantastical stone made by the Banians.

Upon a farther discourse concerning the burning ditch in Lancashire, Sir JOHN LOWTHER gave a relation of that strange phenomenon, and added some remarks not taken notice of before, which he was informed of by Sir ROGER BRADSHAIGH. The substance of which was, that there was underneath the ground a coal-mine; and that at the place, where the steam could be kindled, there were cracks and chaps in the earth; by which it was supposed, that the damps of the coal-mine collected in the cavities thereof, and issuing continually from it, did by these crannies and chaps of the ground issue continually at that place; and thence whenever an actual flame or fire was brought to touch it, it presently kindled and continued to flame till it was put out.

Mr. HOOKE took notice of the admirable effect, which had been observed in it, viz. that it took fire, though the steam itself were not before sensibly warm; which, he said, was more than any other steam would do; and that therein seemed to be the greatest rarity of it: whence he conjectured, that it might be the same kind of steam, which generates lightning. That this steam seems to be the very same with the fiery damp of mines, which will take fire much after the same manner, but often with more dreadful effects, by reason that a much greater quantity of the said vapour is collected, and also because it is imprisoned and shut in with very strong sides, and hath no possibility of venting and expending otherwise than by the mouth.

There was much debate concerning the firing of the steam and smoke of boilers, but there was no instance given, wherein steams would take fire, unless they had

had been before heated to a very great degree of heat by an actual fire, and then kindled.

Sir JOHN LOWTHER conceived, that there was a difference between this and other subterraneous vapours in coal-mines; because these flashed like lightning, whereas those of the ditch continued burning. Sir JOHN HOSKINS mentioned, that there was a sort of earth near Green * *, which being scraped, and straw covered with it, would fire the straw. Dr. ALLEN added, that there was also at the same place such another burning fountain.

Sir JOHN LOWTHER mentioned a fire in the New Castle pit, that in the space of forty years had burnt under ground about a mile in length, and a quarter of a mile in breadth.

He related the manner of working in coal pits so as to support the earth overhead; which was, that they placed wooden props on each side in a row, as they proceeded; and that they often take up one as soon as they had fixed another, leaving the mine only of such a breadth, as they had found by experience would sustain the earth over-head without falling in; and that for the better keeping up of the earth over-head, they usually leave about half a yard thickness of the coal untouched. The breadth of the space, which they could thus trust without wooden props in the Newcastle coal, was not more than three yards or nine feet; but the Scots and those places also supported only upon small pillars of $1\frac{1}{2}$ foot square of the same coal.

He remarked farther, that Newcastle coal will decay and dissolve with the air and rain, and lose much of its strength in burning.

He was of opinion, that it would be much for the interest of the Newcastle-men, if they would all join together, and work only one mine at a time, since it would be sufficient to serve all England; and that the same charge would serve for draining that mine, which was to serve all, that is now expended upon the same, now it serveth but a sixth part.

Mr. HENSHAW observed, that pearls were called *uniones*, from their likeness to an onion, which was called *unio* from the single growing.

The experiment exhibited was of an ivy cup filled with wine and water; but upon standing an hour and more, neither seemed to stream through, whereas it was expected that the water should have strained through, and the wine have remained behind.

Sir JOHN LOWTHER was desired to inquire of the president concerning Sir ROBERT MALPIGHI's letter; and to bring to the next meeting the pieces of plant sent

sent by that gentleman: upon which was occasioned a discourse about the descending of the sap by the bark; Dr. GREW denying, that it descends by that way.

November 28. Mr. HENSHAW, the vice-president, in the chair.

The stones produced at the last meeting by Mr. HENSHAW being since polished were shewn, and appeared to be as hard, and bore as good a polish, as agates; and had a very beautiful variety of colours and spots in them.

There was also a farther discourse concerning some expeditious way of cutting, drilling, turning, and polishing the said stones into several shapes for various uses.

Mr. HUNT made his report, that having been to inquire after the books left at Arundel House, he was informed by Sir WILLIAM DUGDALE, that those books were in the custody of Mr. BURBURY, the duke of Norfolk's gentleman. And Dr. GALE reported, that he had spoken with Sir WILLIAM, who had proposed, that as soon as he should receive those books, he would send the copy of Doomsday-book to the Society.

The minutes of the last meeting were read, which gave occasion of discoursing farther concerning subterraneous steams and fiery damps.

Dr. ALLEN took notice, that there was mention made in Mr. RAY's *Travels*, of a burning fountain in Dauphiny in France, which being set on fire would burn very violently, and would serve both to fry and roast meat; and that the inhabitants near it made use of it for that purpose.

This gave occasion to discourse of bituminous substances. Mr. HENSHAW mentioned, that there was a kind of liquid bitumen, which swam upon the *mare mortuum*.

He remarked likewise, that ambergris seemed to be somewhat of that nature, since it had been often found to float on the sea; but that amber or *succinum* was of another nature, and was generally found at the bottom of the sea.

He took notice also, that Mr. BOYLE had a method of including insects in a clear colophony, made by the evaporation of curpentine, which being cold and hard would very much resemble true amber, and preserve any insect put into it very intire.

Mr. HOOKE affirmed, that he himself had a way of inclosing an insect, such as a fly-worm, or the like, in amber artificially, which could scarce be distinguished from a natural production of that kind.

He added, that he was of opinion, that amber was nothing else but the turpentine or resinous gum of trees, which having lain a long while in the sea or under

der ground was in process of time petrified, or at least hardened to that degree, in which it was found : which he was the more inclined to believe from the experiment, which Dr. DANIEL COX had tried upon the earth found some years before at Ivington ; the oil of that earth smelling perfectly like oil of amber, which was made to have that smell from the burying of colophony there by a chemist.

Mr. HENSHAW remarked, that the smell of yellow amber, when rubbed, was very much like that of rosemary.

Sir JONAS MOORE gave an account of the manner of the firing of a damp in a coal mine at Lumley, which was with so great a violence, that it shook the earth for a considerable way round about, and carried some miners, who were going down into it, a very great height into the air, and blew up also aloft into the air all the building, that stood over and about the mouth of the mine.

Sir PAUL NEILE hereupon related the manner, in which the cure for these kinds of damp was found out accidentally ; which, he said, he had received from Sir WILLIAM LAMPTON, the owner of the abovementioned pits or mines ; and which was to this effect. The miners having been above making merry, and being accidentally into the mouth of the coal-mine, set fire to the damp, and made it discharge with a very great noise, and shaking of the earth. Upon taking notice of this, and the cause of it, they after a little space of time tried by designedly throwing down burning coals into the mouth of the mine ; and presently falling down flat on their bellies on the ground observed, that the mine again took fire, and blew up into the air with a great noise. This they repeated several times one after another, till they found, that it would fire no more : after which they ventured down into the mine without any succeeding injury from the said mine for the remaining part of the day. But for fear lest they should be farther incommoded by the said fire damp, they always in the morning, before they go down, endeavour to fire the said damp, by throwing down lighted coals till the pit will fire no more.

Sir JOHN HOSKYNs related, that there was a pit at Brosley in Shropshire, where, if a candle were held near to the ground, the steam or damp would take fire ; but if the candle were held higher at a distance, the same effect would not follow.

November 30. the anniversary election-day, there being present thirty-three members, and the president, Sir JOSEPH WILLIAMSON, in the chair,

Mr. Hooke read the report of the committee appointed to audite the accounts of the treasurer, Mr. HILL, for the preceding year^a.

After which the several candidates formerly proposed were balloted for and elected,

^a This report was omitted to be entered in the Journal, vol. vi. p. 138.

1. FRANCIS ASTON, Esq; proposed by Dr. EDWARD BROWN, by twenty eight votes, no negative.
2. Dr. MAYOW proposed Mr. HOOKE, twenty-seven votes, one negative;
3. Mr. DAVID HANNSIUS proposed by Mr. HAAK, twenty-eight votes, no negative.
4. JOHN VANDE BENDE, Esq; proposed by Mr. HAAK, twenty-eight votes, no negative.
5. Mr. WILLIAM PERRY, proposed by Dr. MAPLETOFT, twenty-nine votes.
6. Mr. DETHLEVUS CLUVERUS, proposed by Mr. HAAK, twenty-nine votes.
7. Mr. EDMUND HALLEY, formerly proposed by Sir JONAS MOORE, thirty-one votes.
8. Mr. JOSEPH MOXON, proposed by Mr. GEORGE ENT, twenty-seven votes, four negatives.

Mr. ASTON, Mr. BENDE, Mr. PERRY, and Mr. MOXON were admitted.

The statutes relating to the manner of proceeding in the elections of the council and officers being then read, the Society proceeded to it, Mr. HERBERT and Mr. AUBREY being first chosen to inspect the proceedings of the secretaries.

Eleven members were continued of the council.

Mr. COLWALL,
Dr. GREW,
Mr. HENSHAW,
Mr. HILL,
Mr. HOOKE,
Sir JOHN HOSKYNs,

Sir JOHN LOWTHER,
Sir JONAS MOORE,
SETH lord bishop of Salisbury,
Sir JOSEPH WILLAMSON,
Sir CHRISTOPHER WREN.

Ten members were likewise chosen into the council.

Mr. AERSKINE,
Dr. ALLEN,
Dr. BROWN,
Mr. CREED,
Dr. CROUNE,

Dr. GALE,
Mr. HAAK,
Sir JOHN LAURENCE,
Dr. MAPLETOFT,
Sir THEODORE de VAUX.

The president, treasurer, and secretaries were chosen again for the next year.

^r These names were omitted to be entered in the Journal, vol. vi. p. 139, but are partly supplied from the Council-book, and a list of the members for 1679.

Between

ROLANDO PRETI, London, 1660, 8vo. 3. *A Platonic Discourse of Love*, written in Italian by JOHN FICUS MIRANDULA: printed in 1651, in 8vo. 4. *Sylvia's Park*, by THEOPHILE, *Acanthus Complaint*, by TRISTAN, *Orontes*, by PRETI, *Eche*, by MARINO, *Love's Embassy*, by BOSCAN, *the Solitude*, by GONGORA; all printed with his own poems in 1651, in 8vo.

He married while he was young. DOROTHY, eldest daughter, and one of the coheirs of Sir JAMES ENYON of Flowre in the county of Northampton, Bart. by whom he had the accession of a good estate to his own. He died at his lodgings in Suffolk-street, in the parish of St. Martin's in the Fields in the city of Westminster, April 12, 1678, and was interred in the church there. He left behind him a son of both his names, educated in Pembroke Hall in Cambridge, who, when very young, translated into English CLAUDIUS ÆLIANUS's *Various Histories*.

December 5. Mr. HENSHAW, vice-president, in the chair.

Mr. HOOKE presented to the Society a discourse, which he had lately received from the president, written by Signor MALPIGHI concerning the anatomy of plants, being a farther prosecution of that excellent work of his formerly printed. It was dedicated to the Society, and contained, besides a preface and conclusion, seven several heads or subjects of inquiry. 1. Concerning the vegetation or growth of seeds. 2. Of galls, or the round excrescences growing on an oak. 3. Of the various tumours and excrescencies of plants. 4. Of the hairs, down, and thorns of plants. 5. Of the clasps and the like binding parts of plants. 6. Of those plants, which vegetate upon others. 7. Of the roots of plants. Each of these subjects was illustrated by a great number of schemes and delineations most curiously drawn with distinction of black and red for the better explanation. After the reading of the dedication, which testified the author's great respect for the Society, it was ordered, that a letter of thanks should be sent by Mr. HOOKE to him; and that Mr. HOOKE should also take care, that the discourse be forthwith printed with all possible correctness; and that a good number of the printed copies be transmitted to the author.

The minutes of the meeting of November 28, being read, gave occasion of discoursing further concerning the productions of our own country as to rich and precious stones. Mr. HOOKE affirmed it possible to make as good agate-cups as any brought from the Indies, out of certain flints and other stones plentiful enough in England; and that there was no difficulty of doing this, except the charge of the diamond-powder to cut them, which yet might, in some measure, be supplied by emery or other powders.

Mr. POVEY hereupon speaking of stones full of a variety of figures, remarked, that he had a considerable number of such stones, which he promised to present to the Society for their repository.

He

He observed farther, that he had been attempting to make an urn clay like the curious porphyry * * of the king; but that it would not bake of that thickness without breaking.

Mr. Hooke mentioned, that there was a method of making very thick pieces of earth to be burnt, without breaking or chopping: that Mr. DWIGHT had made some heads of earth as big as the life: that his earth was as hard as porphyry: and that the excellency of China-earth was, that it would endure the greatest fire without vitrification.

From this discourse of stones and earth arose one concerning metals and minerals, and particularly about the way of making brass. Mr. POVEY promised to bring in the whole method of making brass, practised in the forest of Dean, where there were vast quantities of lapis calaminaris to be had. Dr. BROWN promised also to communicate his observations on that subject made by him in Hungary.

Mr. POVEY mentioned a sort of ambergrise, which had been taken upon Florida, and brought over with a king of that country: that this ambergrise had not exactly the smell or consistence of the true ambergrise, but seemed rather to be somewhat more bituminous. He was desired to bring some of it, that it might be seen and examined, which he promised to do.

He added, that he had a sort of cotton-cod, which produced a down as fine as any silk, though it were but short, and not much larger than that of a thistle: of which he promised also to produce a specimen at some meeting of the Society.

Mr. WHEELER remarked, that scammony produced some such cog and down, and promised to bring some of it to the Society.

Dr. BROWN discoursing of Hungary, mentioned, that Mr. BEMDE, a member of the Society, had seen a vine, in which some grains of gold were said to be found growing: which Mr. BEMDE was desired to shew to the Society: but he said, that it was a mistake, that he had any such vine; but that count WALSTEIN had a bracelet of such.

Upon discoursing on mercury, it was remarked, that it was brought over in copper-balls.

Mr. Hooke produced part of his new weather-clock, which he had been preparing; and which was to keep an account of all the changes of weather, which should happen, viz. 1. The quarters and points, in which the wind should blow. 2. The strength of the wind in that quarter. 3. The heat and cold of the air. 4. The gravity and levity of the air. 5. The dryness and moistness of the air. 6. The quantity and levity of rain, that should fall. 7. The quantity of snow or hail, that shall fall in the winter. 8. The times of the shining of the sun. He was desired to proceed to the finishing of this, which, he said, he hoped to do within a month or six weeks.

He promised also to shew at the next meeting, an experiment in the condensing engine, which he had procured to be now mended and fitted for many experiments.

December 12. Mr. HENSHAW, vice-president, in the chair.

Mr. Hooke produced the condensing engine, which he had caused to be mended and made much more serviceable for trial of several experiments therein, of the effects of condensed air.

An experiment was made to see the effect of condensing the air in a gage or standard, which was suspended within the cavity thereof.

It was desired by the Society, that it might be tried at the next meeting in the engine upon some animal, in order to see how much longer a creature would continue alive in the engine filled with condensed air than when filled with common air.

It was ordered, that the rarifying engine might be put in order for the trial of the same animals in rarified air, to see how much sooner an animal will expire in rarified air than in common air of the same extension.

Mr. POVEY presented to the Society for their library a small stitched bookin 4to, containing an history of Chelsea College.

He presented likewise for their repository the claw of a West India spider, very much resembling the claw of a lobster or crab; given him by the lord WILLoughby of Parham as a present remedy against the tooth-ach.

He likewise produced some glass-drops, in order to shew the experiment of their violent bursting and discharging the parts of it upon the breaking of the small end thereof. The small end of one of these was broken by a pair of piers, and the whole body of the glass flew asunder and dispersed its parts every way with great briskness.

Mr. Hooke mentioned, that the manner of the breaking of the body might be seen, if the same were dipped two or three times in very clear transparent gliew; which, it was desired, might be prepared accordingly against the next meeting for making the experiment.

Mr. Hooke reported, that he had treated with Mr. MARTYN, the Society's printer, for the well printing Signor MALPIGHI's discourse lately sent to the Society; and that he had desired Mr. MARTYN to print fifty copies extraordinary, to be sent to the author as a present from the Society.

Mr. POVEY moved, that a letter of thanks might be written to Signor MALPIGHI.

RIGHT from the Society; and that the said letter, after it should be read and approved by the Society, might be printed with the book.

Upon a discourse about some sorts of the lesser precious stones, as agates, mocha stones, onyx's, &c. Mr. POVEY related, that the heliotropium was an excellent stone for striking fire instead of a flint. Marcasites were also mentioned as a sort of stone, which afforded much fire upon striking; and it was supposed, that the reason was, because those stones abound with sulphur.

But it was farther discoursed, that the most conspicuous sparks, that fly from the striking of a flint against a steel, were the small parts of the steel cut off by the flint, and vitrified by the violent motion of the stroke, the sulphur of the iron readily taking fire. For a proof of which, Mr. HOOKE shewed an experiment by throwing the filings of iron through the flame of a candle, which immediately kindled and sparkled like gun-powder.

Mr. BROWNE related the way of collecting the golden sands of the river Danube, which was by throwing the sand with water upon a board laid a little aslope, and cut with many notches like the teeth of a saw, with the teeth turned upwards, and against the slope: by which means all the particles of gold would lodge themselves in these teeth or notches, whereas the lighter sand, gravel, and dirt will all wash away. He said, that he had some of the said powder here in England, which he had brought from the Danube; and he promised to produce some of it at the next meeting.

He remarked, that the people by this means of collecting and washing sand would earn six or seven shillings a-day, though their gain thereby were inconsiderable in comparison of the value of the gold, which they thus collected; the profit of which intirely belonged to the emperor, or those, who farmed it of him.

Hereupon some opinions were mentioned about the original of gold.

Mr. HENSHAW said, that it was an inquiry worth consideration, whence the several shapes of gold proceeded, viz. that found in the mines, and that washed out of the sand or rivers; since they seemed to be very different, that found in mines being always found in thin planks imbedded in a hard stone; but that in rivers being of a quite different shape, like sand. Hence he conceived it worth inquiry, whether it might not be generated out of the river itself.

Mr. HOOKE was of opinion, that the original place of gold lay extremely deep in the earth, as being a body heavier than any other yet known, and consequently ought to lie lower than any in order: that had it not been for some former earthquakes and eruptions, it would have still remained in those inaccessible recesses, and so have never been known, as in all probability many other sorts of stones, minerals, ores, and metals, which may lie below the surface of the earth. Fires, may remain concealed and unknown to this day: that by means of subterraneous fires, earthquakes, and other vapours, that cause those effects, these deep-seated

and inner parts of the earth may have been thrown up together with the other effect of the same cause, the very mountain: that that part of it, which is thrown up into the top or body of the mountain, may by the violence of the heat and discharge of the vapours be melted in the rising, and dispersed and broken into a multitude of very small globules, or such like figure, and so be blended and mixed with the earth, sand, &c. of the new eruption: that being thus mixed with the earth of the mountain, the rain falling on the upper part thereof, and descending, washeth down into the rivers those smaller particles of the gold, and so leave them in the bottom of their channels.

Mr. WHEELER produced and presented for the repository a cod of scammony mentioned at the preceding meeting, bearing a kind of down like silk, growing on the end of the seeds like those of dandelion; by which they fly in the air like those, and by the winds are dispersed to a great distance.

Mr. POVEY, according to his promise at the last meeting, produced some papers, containing his observations about the method of making brass, which had been formerly tried in England. These papers were read by him, and delivered to Mr. HOOKE in order that they might be copied into the Registers of the Society.

In these papers were mentioned the proportions of tin and of lead to be mixed with copper, in order to make bells, guns, and pots.

Mr. POVEY read likewise another paper of Mr. ELSING concerning some copper manufactures.

Mr. HOOKE read a letter from Mr. JOHN LOCKE, dated at Padua, giving an account of the late total eclipse of the moon observed there by an ingenious acquaintance of his, and offering his best endeavours for the service of the Society in those parts.

Mr. HOOKE was desired to return the Society's thanks to Mr. LOCKE for this letter, and Mr. HENSHAW moved, that he might be desired to procure the history of the making of verdigrise with wax, and that of the kermes berry, both as to its growth, manner of gathering, preserving, use either for physic, dying, or the like.

M^{rs}. EZEKIEL SPANHEIM, resident from the elector Palatine, was proposed candidate by Mr. HAAK.

December 19. Mr. HENSHAW, vice-president, in the chair.

The minutes of the last meeting were read; which gave occasion of discoursing about pearls, and of the places of finding them: whereupon Mr. BEMER related,

* No copy of them is inserted in the Registers.

that

that many pearls were found in a river, which runs into the Danube near Passau: that these pearls were very good; and that they were found in the very mud of that river, and not in the shell of any fish: and thence it was supposed, that they were cast by some fish out of their stomachs, since it had been observed by Dr. KINO, that the pearl in oysters is generated in the stomach of that fish.

There was also a farther discourse about the manner of the production of metals in the bowels of mountains. Whereupon Mr. HENNAW declared it as his opinion, that many metals, as gold, were generated and perfected in the superficial parts, as well as in the body of them. But Mr. HOOKER endeavoured to explain how those bodies might be original bodies belonging to a much lower region of the earth; and that they were not produced or generated a new, but only by earthquakes and subterraneous eruptions thrown up from their more natural place, and by the violence of those fires melted out of the minerals, in which they were there bedded; and that thence they came to be disposed and scattered into small grains and dust, and found intermixed with very heterogeneous bodies.

Upon the mention of Mr. LOCKE's letter, Sir JOHN HOSKYNs gave an account of the manner of making verdigrise with the husks of grapes, after the expression of their juice, and small plates of copper thrown and buried amongst them.

Sir JOHN HOSKYNs presented to the Society for their repository a branch of white coral, which he received from Mr. GORING BALL. It was singular in this, that the ends of the branchings were terminated with a kind of pearl, the ends being hollowed like a cup with six small ribs within, each of which ended in a small knob or pearl; and between each of these was orderly placed another small knob, amounting to twelve in all.

Mr. BENDE produced some of the sand mentioned by him at the last meeting to have been taken up in the Danube; which was some of that, out of which the people separated the golden dust by washing. Some of it was delivered to Mr. HUNT for the repository.

Mr. BENDE presented likewise a black stony substance, intermixed with a curious green, which he had taken up on the mountain Vesuvius. It had the appearance of a black and green glass; and thereupon it was tried with a coal, and the flame of a candle cast on it with a foddering pipe, in order to see, whether it would melt; but upon trial it was found not to melt, but to be a real stone.

Mr. COLLINS presented from Mr. MARTINDALE a proposition or discourse of compound interest or annuities, contained in three leaves of paper in 4to. to be printed, if the Society should think proper, with some other papers.

Mr. ENT produced a root of barley, out of which grew thirty stalks, on each of which was an ear of barley.

Sir JOHN HOSKYNs produced some of the powder taken out of Dulwich well-water.

The experiments exhibited were in order to shew the use of air for the sustentation of the life of an animal: upon which subject the query was, whether the same animal would continue to subsist in an inclosed air for a time proportionable to the quantity of air contained in the vessel? Whether the said air were free and under no extraordinary compression or dilatation? Or whether it was either compressed or dilated by the force of the engines made for that purpose. In prosecution of this inquiry there were several birds provided, one of which was inclosed in a glass vessel with common air: a second in a receiver, out of which the air was afterwards exhausted; and a third was to be inclosed in the condensing engine, into which double the quantity of air was to be forced. The event was, that the bird in the exhausting engine presently died; but the other in the common air continued in the receiver till the Society rose, without any sensible alteration: whence it was judged, that it would live a considerable time longer before it was stifled.

December 26. At a meeting of the COUNCIL were present

Mr. HENSHAW, vice-president, in the chair.
Sir JOHN HOSKYNs,
Dr. GALE,
Mr. HILL,
Mr. COLWALL,
Mr. ALLEN,
Dr. BROWN,
Dr. GREW,
Mr. HOOKE.

It was ordered, that the treasurer repay Mr. Hooke the five pounds paid by him to Mr. CRAWLEY for workmanship about the weather-clock; as also his salary for half a year ending at Christmas, voted by ballot.

Dr. GREW was put in mind to procure the Museums for the library of the Society, according to the desire and direction of the president.

It was ordered, that the treasurer give to Dr. GREW ten pounds as a gratuity for his service to the Society as secretary, voted by ballot:

That the treasurer pay Mr. WICKS one year's salary ending at Christmas, 1677, voted by ballot:

That Dr. GREW have liberty to borrow such of the natural rarities in the repository, as he shall have occasion to describe; and that he leave a catalogue of the same with Mr. HUNT, till he return them; which is to be within one week: voted by ballot: And

That Mr. Hooke be desired for the future to keep the correspondence of the Society; and that the same shall be continued by the help of a small journal of some particulars read in the Society: that the said Journals shall not be sent or sold

sold to any person but members of the Society, and to such as correspond with Mr. Hooke by the Society's directions, and make considerable returns to him for the Society's use; all which returns shall be constantly brought into the Society, and read before them at the very next meeting after the receipt thereof. And Mr. Hooke was desired to draw up a specimen of the said Journal propounded by him against the next meeting of the council: voted by ballot.

A paper brought in by Dr. GALE, containing rules for the keeping of the library, was read and approved; as follows:

"Orders concerning the government of the *Bibliotheca Norfolciana*.

"1. That the long gallery in Gresham College be the place for the library, if it may be procured.

"2. That an inscription in letters of gold be set up in some convenient place in honour of the benefactor.

"3. That there be an exact catalogue of all the books of the *Bibliotheca Norfolciana* made apart, and also of all other books, which shall accrue.

"4. That for securing the books, and to hinder their being embezzled, no book shall be lent out of the library to any person whatsoever.

"5. That such person or persons, as shall desire to use any book in the library, shall return it into the hands of the library-keeper entire and unhurt.

"6. That the library shall be surveyed once in the year by a committee chosen by the council to the number of six, any three of which to be a *quorum*."

It was ordered, that Mr. Hooke do agree with Mr. BRADLE about two rooms, which he desires of Dr. POPE's lodgings; but that he do not let them under five pounds *per annum*.

1678, January 2. Sir CHRISTOPHER WREN, vice-president, in the chair.

Dr. GREW read a letter in Latin to himself from CHRISTIAN MENTZLIUS, counsellor and archiater to the elector of Brandenburg, dated at Berlin, 21st July, 1678, expressing his kind acceptance of the offer, which had been made him of holding correspondence with the secretary of the Society, and his desire of continuing concern as he had formerly begun it with Mr. OLDENBURG; and more especially concerning such inquiries, as he had with great delight been much employed in, the nature, qualities, and species of vegetables. In the postscript of this letter he makes mention of the eighth year of the Ephemerides *Nature Curioforum* at Breslaw, wherein was inserted a translation of Dr. GREW's *Anatomy of Vegetables*: and that

¹ Letter-book, vol. viii. p. 56.

JACOBUS BABYNIUS of Dantzick had that year published *Centuria Plantarum rariorum, præsertim ex promontorio Capitis Bonæ Spæ desumptarum, cum figuris æneis summa arte ad usum incisâ*, in folio.

Dr GREW read likewise a letter to himself from E. LEICHTNER, dated at Erfurt, 15th November, 1678*, containing an inquiry after some things, which he had formerly sent, and received no answer about; and also a printed half sheet, intitled, *D. E. Leichtneri excerpta Diatypesi tractatus de Physico-Medica Analysi, in duos distincti Libros*: by which he hoped, that natural philosophy and physic might obtain its utmost felicity.

The minutes of the last meeting of December 19, being read, on the mention of the barley, that produced such great increase, Mr. HENSHAW remarked, that there was a *trititum multiplex* first brought from Persia, which would yield two thousand for one. This was seconded by Sir JOHN HOSKYN, who observed, that it would do the same in any other plant, he having found it upon trial to succeed. He added, that the stalk of it was not hollow like other wheat, but solid; and that it was much preyed on by birds.

Upon the mention of pearls, Mr. HENSHAW observed, that they were often found in fresh-water as well as in salt, viz. in a sort of horse-mussels found in rivers.

Upon a discourse about sand gold, Sir CHRISTOPHER WREN remarked, that the figure thereof for the most part was shaped like * * or salts of regular flat sides and angles; and that it was seldom found like small particles of a melted metal; that he had seen bags of these sands, the most part of which were thus shaped, and yet very pure gold.

Dr. PLOT, upon the discourse of barley, made mention of a certain sort of barley called Patney barley, from a place of that name in Wiltshire. This barley, he conceived, would be of great use in cold countries, by reason that it will be thoroughly ripe in nine or ten weeks from the time of its sowing; and consequently come within the limits of the shortest summer. Of this he had given an account in his *Natural History of Oxfordshire*. By others it was called rare ripe barley.

Mr. HOOKE gave an account of the experiments, that had been shewn at the last meeting, and the design of them, and of the time and manner requisite for the completing such experiments; and he desired, that there might be a committee appointed for the making such trials, as could not be made within the time of the sitting of the Society, since many experiments could not be made within so short a space.

Dr. PLOT left with the Society a printed sheet of his inquiries, made in order

to the writing of the natural history of all parts of England. This he did with a desire, that it might be perused by the members, and such alterations made therein, as they should see reasonable.

Mr. Hooke shewed an experiment with gun-powder, in order to examine whether the burning thereof consumes or produces more air. And upon trial thereof it was found, that^d

January 9. The president, with Sir JOHN LOWTHER, Mr. HENSHAW, Mr. TRYNNER, and several others, went up into Mr. Hooke's turret, to see the farther progress, which had been made in the clock contrived by Mr. Hooke for keeping an account of the several variations of the weather; which was well approved of by them.

The president took the chair.

The minutes of the last meeting of January 2. were read; whereupon mention was made by the president of continuing and promoting correspondence with foreign parts; and it was desired, that the proposal made by Mr. Hooke should be farther considered of by the council, in order to the promoting of that design.

Upon the mention of gold powder, &c. Mr. HENSHAW farther observed, that all gold, that was not found in rivers, was found imbedded in very hard stones, and so seemed to be generated in them. And that such, as was found in rivers, was for the most part found in such parts of them, where they made any considerable bend or turning or eddy.

The question concerning the figure of dust or sand-gold was farther debated; and it remaining yet a doubt, whether it was found so figured, as had been supposed of regular figures, it was desired, that Mr. Hooke should endeavour to get a sight of some dust gold, and examine the same with care, to see and describe the most usual figures thereof.

On a discourse concerning the mineral of copper, Sir JOHN LOWTHER related, that there was a sort of mineral found in Cumberland, which seemed to be a very rich copper ore; but that having sent the same to be tried at London, it was found to burn and flame all away like brimstone, and to yield no copper at all.

Mr. Hooke remarked, that this might probably happen from the mixture and union of some salts and sulphurs with the metal; and that if they were not by some other artifice separated from the metal before the same come to be tried by the violence of the fire, without such artifice or mixture, the sulphur and salts would carry away the metal of the copper, and never suffer it to melt or separate from them into a body. For confirmation of this he alledged, that he knew a way to make even the body of common copper commix again with such heterogeneous

^d This minute was not completed.

ous bodies, and being put into a fire to fly all away, and burn almost like common brimstone; which copper so ordered might yet be again reduced so as to melt, and not fly away at all.

Mr. HENSHAW related a way of making a brimstone out of copper.

Sir JOHN LOWTHER gave a description of the copper-mines.

Mr. HOOKE gave an account of the design of the experiment about respiration, and moved, that there might be a committee appointed of the physicians and such other members of the Society, as desired to be further satisfied concerning that inquiry, in order to make that experiment on some other day than that of the meeting of the Society, since that experiment could not be tried within the time of meeting; and he proposed it as a very desirable thing for the promoting the ends of the Society, that the committee formerly appointed for the trial and examination of several matters might be revived.

Hereupon a committee was appointed to make trial of this experiment of respiration, consisting of Dr. CROWE, Dr. MAPLETOFT, Dr. ALLEN, Mr. HILL, and such others of the Society, as should desire to be present at it.

Upon this a discourse arose about respiration.

Dr. CROWE was of opinion, that the steams from the breath and body were the occasion of the death of such animals, as were inclosed in a vessel. Mr. HOOKE objected, that if this were so, then an animal included in condensed air would be stifled by those steams sooner than one included in a vessel, out of which a part of the air was exhausted; whereas the quite contrary appeared by experiment. He added, that he rather conceived it to proceed from the fastening of the dissolving part of the air, and so making the remaining part effete and useless for maintaining the life of animals, which seemed to have much the same nature with flame and fire, since the same effects seemed to happen to it. Hereupon Mr. HENSHAW mentioned the experiment, that had been formerly given to the Society; which the president desired be again shewn at the next meeting.

January 16. The president in the chair.

The minutes of the last meeting being read, the president took occasion to propound it as a matter desirable, that an account should be procured of the observations made of the quarters of the wind in the several parts of the kingdom; of which the letters from several parts gave an account.

He also inquired, whether Dr. GOAD^e had perfected his theory of predicting the quarter and strength of the winds from astronomy. To which Sir JONAS MOORE answered, that Mr. FLAMSTEAD had examined several of Dr. GOAD's

^e JOHN GOAD, M. A. master of Merchant-Taylor's school in London. His *Astronomia* was published in 1686. His predictions,

predictions, but had not found one of them true. But Mr. HENSHAW had examined them continually for about two years about a month since, and had found not above one of four false.

The president then inquired, why the Society did not receive some account from Mr. FLAMSTEAD: to which Sir JONAS MOORE answered, that he would within a fortnight be ready to produce a book of his observations.

It was likewise inquired what was become of the instruments of the Society, that had been carried to Greenwich; and it was desired, that they might be returned to the repository, in order that they might be ready for the use of the Society.

The president inquired of Sir JONAS MOORE concerning an experiment, which he had been informed of, viz. of the throwing a copper farthing into a liquor, which being ** would prove good gold.

Mr. HENSHAW supposed, that it might be done somewhat after the manner of precipitating silver out of *Æ.* upon copper-plates.

Mr. HOOKE mentioned another experiment somewhat like it, whereby iron was said to be turned into copper: and Mr. HENSHAW mentioned the chains said to be turned from iron into copper by the mineral waters in Hungary brought from thence by Dr. BROWN.

Mr. EVELYN related, that salt of silver being dissolved in water might by mercury put into that water, then evaporating it, and expelling the sediment, be reduced to silver again.

Hereupon Mr. HENSHAW related, that the duke of Buckingham had a method of making mercury, which would grow hot by dissolving gold. Dr. CAOUNS added, that Mr. BOYLE had done the same thing; but had said, that the experiment of making this mercury did not always succeed.

Mr. HENSHAW related a like experiment of augmenting gold made by Dr. KUFFLER*, which was made by an aquafortis made by the help of sand taken out of the ballast of a ship; which experiment being tried with other sand he found not to succeed.

Mr. HENSHAW farther gave an account of the manner, how Dr. KUFFLER hatched chickens by the help of furnaces, the process of which he had seen; which was, that the doctor had a wire-grate placed over a balmum at a foot distance with a cover over, pulled up by a pulley; in which grate he set the eggs, and so turned them every day for eighteen days together: then he said

* Sir JONAS MOORE's answer to this question is not inserted in the Journal. vol. ii. p. 151.
* In the minutes it is by mistake *Kyler*.

them on a hair-cloth in a stove near the ash-hole, where they hatched themselves with their own bills; in which stove he kept them for three days, till they could feed themselves, which was when the yolk was consumed in their bellies. He added, that in Egypt they do this with camels dung.

Sir JONAS MOORE remarked, that Sir CHRISTOPHER HUYDON, together with DRUGALL long since in the Minorities hatched several hundred eggs; but mentioned not the way; but that it had this effect, that most of the chickens produced that way were lame and defective in some part or other.

He added, that DARNELL had an art, by which he could produce a fly in an hour's time any where.

Dr. CROWE related his own observations made with the eggs of a pullet, which, he was assured, had never been trod by a cock, and yet laid five or six eggs in a week. This he was assured of, as having kept the pullet in a coop from the time it was hatched, and never suffered any cock to come near her. These eggs being set under a hen proved addle and effete; but being examined by him before they were sitten upon, he found the cicatrula as in other eggs, and the body of a chicken formed in the cicatrula. Hereupon the doctor was desir'd to prosecute this experiment yet farther, and to examine the cicatrula with a microscope, and so shew it to the Society.

Sir JOHN LOWTHER promised to procure some of the copperas ore, in order to its being examined by Mr. HOOKER.

He desired to be informed of the nature of the Swedish * * and what quantity of copper it contained, and how it was smelted.

Sir JOHN HOSKINS remarked, that GLAUBER had shewn the way how to extract a metal out of the pyrites.

Upon a discourse concerning the ways of making salt, Mr. HOOKER related, that he had been newly informed by a doctor, who had lived in Ireland, that he had salt-works in the north-west parts of Ireland, where he boiled up the sea-water into salt in iron-pans by the help of turf or peat to great profit or advantage.

Sir JONAS MOORE observed concerning peat-pits dug in the fens, that they will in a short time fill again with good peat fit to be dug.

Sir JOHN HOSKINS related, that he had observed the same thing in Bedfordshire.

Sir JONAS MOORE mentioned, that there was at the top of Pendle-hill in Lancashire a plain about a quarter of a mile over, which being dug to the depth of about five or six feet, is found to contain great numbers of fossil-tree; supposed to be fir.

He

He added, that this hill was a great receptacle of waters; and that there had been several times observed great gushings out of water from the sides of it, which had happened at several times at the distance of about thirty years.

At the top of this hill grows the cloud berry no where else found.

Dr. CROWE mentioned some such kind of observation of the Springs about Epsom, which once in about seven years were observed to rise and overflow the grounds and cellars thereabouts.

Mr. FRYLON upon this occasion mentioned an instance of a hill, that was hollow underneath, and so must have a great receptacle of water; the river Mole sinking under it on one side, and rising out again on the other. This was Box-hill near Dorking in Surrey, under which the Mole passes.

Mr. HENSHAW observed, that the river Guadiana in Spain is much of the same nature.

Mr. HOOKE shewed the experiment of putting fire into a tin box, and there keeping it blown on with bellows, till it appears to have quite lost its burning and shining; then admitting fresh air into the same, and blowing it with the same bellows, it presently rekindled and burned and shined as before. This was thrice repeated to the satisfaction of the members present. But that some farther proof of his theory might be examined, he was desired to shew some other experiment of this nature at the next meeting.

Dr. CROWE read a letter of his to BORRELLI, to invite him to send over his discourse *De motu animalium*, since the Society would endeavour to procure it to be well printed here. The doctor was thanked by the Society for this letter, and desired to send it as soon as possible.

Mr. HOOKE shewed a second experiment, which was the flame of a candle so placed between the eye and a concave metalline speculum, that the air, which incircumspiced the said flame, by dissolving the parts of it into itself, became of a different nature and different refraction from that, which was not satiated by the said dissolution.

This was plainly seen by the president and divers others of the members present to their satisfaction.

January 23. At a meeting of the COUNCIL were present,

Sir JONAS MOORE,
Sir JOHN HOSKYNES,
Mr. HILL,
Dr. GALE,

Dr. MAPLETON,
Dr. CROWE,
Mr. HARRIS,
Mr. CREED.

It was ordered, that Mr. HILL do take care to collect the *affairs* due from the priory of Lewes, and employ whom he shall think fit for the collecting thereof: And,

That the paper brought in by Sir JOHN HOSKYNs, and here perused and amended, be forthwith fairly ingrossed in parchment, and the instrument sealed and carried to the president.

At a meeting of the SOCIETY on the same day, the president in the chair.

The minutes of the last meeting being read gave occasion to inquire farther of Sir JONAS MOORE concerning Mr. FLAMSTEAD's observations: to which he answered, that a quantity of them were ready for the press, but the book-keepers were unwilling to undertake the printing of them: whereupon Mr. HOOKS was desired to speak with Mr. MARTYN concerning it.

Sir JONAS MOORE likewise gave farther account, that Mr. FLAMSTEAD and Mr. HALLEY had newly made some observations in order to find out the parallax of Mars now achronical and retrograde; and that he had found from examining the observations by calculation, that the parallax of the sun would not be more than 30" nor less than 11", which he conceived was much nearer than any person had hitherto certainly observed it.

Upon the mentioning the turning copper into gold by a liquor, Mr. POWRY related, that Sir THOMAS WILLIAMS had told him, that he had cut a copper farthing in two, and throwing into the liquor, it was dissolved by it, and that upon evaporating the liquor, and expelling the remainder, he had found the same weight of the farthing in good gold. He added, that Mr. SLINKERBY supposed it to arise from the copper's precipitating the gold, that had been formerly taken up by the liquor.

The president related, that his majesty had lately received a letter from Vienna, wherein were inclosed some curiosities relating to the way of making gold, conveyed by Mr. SCHROTER.

Upon an occasional discourse about teeth Mr. HINSHAW mentioned a relation, which he had met with, of artificially setting in new teeth in the place of old ones plucked out; adding, that it was observed, that if the new ones were properly inserted, as soon as the old ones were drawn out of the jaw bone, the gums would close and inclose the teeth as firmly almost, as if they were the natural. He added, that one Mons. DU PONT upon drawing out a wrong tooth, and finding his mistake, had presently clapt it into its place, and closed the gum, which thereupon remained as fixed, as if it had not been drawn.

He gave also a relation of a young lady, whose teeth being much rotted by

eating sweet meats, were drawn out, and the teeth of a young boy being set in their place had fixed there, and grown very well. This was done by Mr. Gosling here.

Upon a farther query concerning chickens produced by fowes, whether they would be fruitful and produce eggs and chickens as others, that were hatched the natural way, Mr. HENSHAW affirmed, that they were absolutely as fruitful in those respects as the others.

Hereupon was occasioned a discourse about spontaneous generation. Mr. HOOKE related, that he had been informed by Mr. WYLD, that he could order earth so, as that without sowing or putting any pease at all into it, it should produce pease: as also that the same Mr. WYLD had told him, that Mons. le FÈVRE, the king's chemist, had assured him, that he having thrown out on a dunghill a pretty large quantity of the caput mortuum of fennel seeds, from which he had extracted the oil by distillation, had observed the following year, that the whole dunghill was overgrown with young fennel, as if it had been sowed with fennel-seeds; concerning which it was conjectured, that the sweepings of the laboratory, which were thrown to the same place, were more probably the cause of this great fruitfulness.

Upon a discourse about the strength of salt, it was conceived, that sea-salt was much stronger than salt made by boiling, by reason that the extraordinary heat of the fire makes a considerable part of the salt rise in fumes; whereas the natural heat of the sun on that, which is made abroad, is not powerful enough to produce the like effect.

Sir JOHN LOWTHER added, that spring waters are much stronger than the sea-water; so that they commonly yield a fourteenth part of salt, sometimes an eighth; whereas sea-water yields not above a two and fortieth part. He farther observed, that the lord LUMLEY's salt was accounted the best.

There was likewise a discourse about making salt-water fresh by filtration; and the opinion was, that no filtration through sand, earth, or the like, would make salt-water fresh.

Sir JOHN LOWTHER mentioned, that at the * * they saved the draining of the salt, and found, that that would very much contribute to the making of more salt by putting it to the brine, that was to be boiled; but on the other hand those, who made salt out of sea-water, usually threw it away, as supposing, that it hindered the producing salt in the next boiling.

Mr. HOOKE observed, that the draining of salt from sea-water was usually very bitter and red, and was for the most part thrown away; only some of it was used for the washing the sores of sheep and cattle, as being a great drier; and he farther conceived, that it was made by a dissolution of the iron boiler, &c. therefore might be of another nature.

Mr. Povey observed, that Sir ROBERT HOWARD had acquainted him, that in this part of a salt-work there was a subterraneous salt-river.

Mr. Hooke threw his experiments; the first of which was the setting a chafing-dish of coals into the box, and suffering it to stay there till it went out, and ceased to shine: then by a hole at the top letting down into the air of the box a wax-candle, it would presently be extinguished, as if it were dipt in water; and that as soon as ever the air came to touch the flame of the candle. But that air being changed, and fresh air admitted into the box, the coals began to shine afresh, and the candle let down into the box continued to burn and shine as in the open air.

His second experiment was by putting in a box filled with lighted coals turning clear, when the air had been initiated, as abovementioned, by the coals, which had been set into it; which coals presently ceased to burn, and looked as if they had been quite extinct; which very coals, as soon as ever the fresh air was admitted, presently began to shine and burn as before.

The experiments for the next meeting were to prosecute this theory of Mr. Hooke, that air is a menstruum, that dissolves all sulphureous bodies by burning, and that without air no such dissolution would follow, though the heat applied were as great.

January 30. Being the anniversary fast for the death of king CHARLES I. the Society did not meet.

February 6. The president in the chair.

This meeting began with a discourse about the barometer and pressure of the atmosphere, concerning which it was debated, what might be the reason, why the air should press less in rainy than in dry weather. Mr. Hooke supposed, that it might proceed from this, that the air at such time, as it is heavy, takes up more of the heavy parts of other bodies; and keeps them suspended; whereas in moist and stormy weather the air being of another nature could not be charged with such vapours.

There was also a discourse about what was fit to be published of the Transactions of the Society's, and in what manner; but the determination of that matter was referred to the council.

The minutes of the meeting of 23 January were read; whereupon there were some other things added about drawing out and setting in teeth artificially.

* They had been discontinued from June, 1677, to n^o 147, for the months of December 1678 and n^o 136, upon Mr. OLDENBURG's death, till January, 1677, when Dr. Grew refused the publication of them, and continued it from n^o 137 to n^o 147, for the months of December 1678 and January and February 1679, after which they were intermitted till January 1683.

Sir JOHN HOSKYNs cited MALPIGHI for asserting, that teeth continually grow; that they have several coats or shells like testaceous substances; and that the outward coats wear off and wear out with using.

Mr. HENSHAW mentioned Monf. du PONT's papers, which were in the hands of Mr. EVILYN, about the way of setting in new teeth artificially. He remarked, that sea-horse teeth afforded the best substance to make artificial teeth of: that these artificial teeth will sink in a little time, if they be not taken out of the gums and cleaned: that they would also in time grow yellow and black: that the hard coat of teeth by rubbing will be worn out: and that thereupon the rest of the tooth suddenly decays.

About the nourishing of teeth Mr. ARDERNE quoted * * opinion, that they are nourished by the *succus nutritivus* from the nerve.

Upon reviving the discourse about making sea water fresh by filtration and distillation, it was generally concluded, that the fresh water of springs proceeds either from the rain, dew, or condensation of the moist air on the tops of hills.

Monf. SPANHEIM was elected.

THOMAS SHERIDAN, Esq; was also elected.

Sir WILLIAM WALLER was proposed candidate by the president and the earl of Aylesbury.

Mr. HOOKE shewed two experiments in order to illustrate his theory about fire.

The first was the letting down a lighted wax candle into a glass of air, which about ten days before had been satiated by a vessel of live coals put into it, and suffered to remain till they were quite extinct: at which time the vessel was closely stopped up, and had been kept so ever since. The effect of which was, that the candle put into it continued to burn a considerable time, as if it had been fresh air. It was conjectured, that upon the condensation of the air upon cooling after the coals were gone out, the fresh air had made its way into the glass, and so refreshed the air, and made it fit for burning. Others supposed, that the air might have recovered its former nitrous quality by letting fall those parts of the coals, which it had formerly dissolved. It was desired, that this should be farther and more carefully prosecuted.

The second experiment was to shew, that a coal, though kept in a very great heat, would not be consumed or burnt, unless there were an access of fresh air. There was a charcoal included in a cylinder of glass, and so perfectly sealed up hermetically: then this glass was put into a chafing dish of live coals, and suffered to lie there a considerable time in a heat great enough to melt the glass, so that the glass shap'd itself into the form of the coal: notwithstanding which the coal remained unconsumed, and manifested the necessity of air for making an actual fire. The

The experiments for the next meeting were to be such, as should farther demonstrate the former theory.

February 13. Mr. HENSAW, vice-president, in the chair.

Upon reading the minutes of the last meeting the Society again entered upon the debate concerning the causes and reason of the motion of the mercury in the barometer: and it was conceived, that it proceeded from the gravitation of the air, which at some times pressed more and at other times less. This variety of pressure was conceived to proceed from two causes; the one, that the air at such time, as the quicksilver rose higher, had a new accession of air at the top thereof, which caused it to have a greater height, and consequently a greater pressure. And the other was, that there were new accessions to the air from the earth, which made the same height of air have different gravitation, and consequently different pressure; the former being explained by a cylinder of the air of the greater altitude, whose parts continued of the same gravitation; the other by a cylinder of the air of the same or possibly less altitude, but the parts thereof of greater gravity and more dense. This was farther explained by shewing, that the heat and cold working upon the same quantity of the air, though it would make the same cylinder of a greater and a less altitude, according as the heat expanded it, and the cold contracted it; yet would not at all alter the pressure thereof, there being in both the same quantity of gravitating parts.

Mr. HENSAW moved, that the substance of this discourse might be drawn up; and that the whole theory might be fully explained, as soon as possible; the barometer being become an instrument of general use, and the causes and reasons thereof very commonly debated amongst the learned.

Sir JONAS MOORE observed, that the barometer at *Tangier* had for near a year very little alteration, but continued always much about the same height.

Previous to the experiment there was much discourse upon those of the last meeting concerning the cause of fire, and it was generally concluded, that the said experiments farther explained and illustrated the theory of fire by the air's consuming, dissolving, or corroding the burning body.

Mr. SHERIDAN was admitted; as was also Mr. FLAMSTEAD, who had been formerly elected.

Mr. HOOKS shewed an experiment, which he had mentioned at the last meeting; the design of which was to see, whether a coal heated to a degree sufficient to melt the glass, that included it, would by that violence of heat be consumed or made to shine and give light. To this end a piece of charcoal was included in a urinal glass so ordered by the means of wires, that the charcoal remained in the middle of the belly of the urinal without touching either the sides or bottom.

February 8, 1677.

Then

Then this urnal was placed upon a chafing-dish of clear burning coals, and so suffered to stand till the belly of the glass was red hot; at which time the mouth of the urnal was close stopp'd with clay. Then the coals in the chafing dish were blowed upon very quick with bellows, whereby the lower parts of the urnal melted, and were thrust inwards by the coals, on which it stood: notwithstanding which great heat the coal in the middle of the glass did not burn or shine, or at all seem to consume, till by taking off the clay, that stopp'd the mouth, and blowing in fresh air with the bellows into the body of the glass, the shining, burning, and dissolution of the coal plainly appeared: and that coal, which before in so much greater heat had remained black, as if cold, now in a much less heat grew all over red, lighted, and presently after the white ashes covered its surface: which was judged an evident sign, that the heat of a fire, though exceedingly hot, was not able to burn a combustible body without air; and that the air was the body, that wrought the effect upon the combustible body.

Mr. GEORGE ENT presented to the Society for their library a book newly published by his father Sir GEORGE ENT, in answer to a discourse of Dr. THURSTON about respiration.

February 20. MR. HENSHAW, vice-president, in the chair.

The minutes of the last meeting of the 13th being read gave occasion to discourse farther concerning the theory of the barometer, from what causes the alteration thereof might proceed.

Some were of opinion, that the cause thereof might proceed from the extraordinary height of the air only ebbing and flowing as it were like a tide, but with unconstant motions.

Mr. HOOKE was of opinion, that to this was to be joined the particular and specific gravity of the body of the air, as being charged sometimes with heavier, sometimes with lighter vapours or bodies dissolved into it, or taken up by it. He further explained how different heights might produce the same pressure, provided there were the same quantity of gravitating within the same cylinder, and inflamed, that a cylinder of the same air rarified in the greatest height of summer could have no more effect in the winter time it is condensed into a much shorter. Farther to elucidate his theory of it he added, that he would at the next meeting produce some experiments.

the next meeting produce some experiments.

Sir JONAS MOORE acquainted the Society, that he had by Mr. TOWNLEY's observations on that subject; as also some late observations of Mr. FLAMSTEAD; and that he would produce them at the next meeting.

It was desired, that the experiments formerly propounded by Mr. H. ...
The Hon. M. D.

¹ Dr. GEORGE EMT's book was printed at London in 8vo. under the title of *ANTI-DIATRICH*.

five Animadversions in *Atalapha* *Diatribam de Respiratione* *usu prae-*

he tried at the column on Fish-street-hill might be anew prepared: and in order therunto Mr. Hooke was desired to provide convenient glasses and other conveniences for the perfecting that trial: and that then the trial might be made with all the care and exactness necessary.

Hereupon it was queried, how this experiment of the different pressure of the atmosphere came first to be thought of; and it was related, that it was first proposed by Sir CHRISTOPHER WREN in order to examine Monsieur DES CARTES's hypothesis, whether the passing by of the body of the moon presses upon the air, and consequently also upon the body of the water: and that the first trial thereof was made at Mr. Boyle's chamber in Oxford.

Mr. HENSHAW desired, that Mr. Hooke would again shew this experiment, which he had formerly produced, in order to explain his hypothesis of the reason of the alteration of the pressure of the atmosphere here.

Dr. Grew desired, that the hypothesis, which he had formerly produced to the Society, might be considered of; for that he conceived that alone to be sufficient to explain the whole theory. The substance of it was, that the pressure of the air proceeds from the salts, that are dissolved into the air: that these salts, when they are dissolved, take less room; and so the air becomes less pent and crowded together, and consequently presses less: but when the salts are undissolved, they take more room, and so crowd the air more, and make it press more upon the stagnant quicksilver.

Dr. CROWE explained also his hypothesis of this phenomenon, which was to this effect:

It was thought very desirable, that queries should be made concerning the different gravitation and pressure of the atmosphere in several parts of the earth, that by the comparing these together the theory might be thereby completed.

Mr. HALLEY affirmed, that he had made observations of the height of the mercury in the barometer at St. Helena; and that he had found the height thereof but twenty-seven inches at the top of the hill, when it was twenty-nine inches at the bottom near the water-side.

Mr. EDWARD TYSON was proposed candidate by Mr. Hooke, as being very curious in anatomy, and one who would be very useful to the Society in producing observations of that kind.

Upon reading the account of the experiments shewn at the last meeting for explaining the hypothesis of fire, and particularly that of the salpêtre, Sir JONAS MOORE was very desirous to know by what means he might certainly find what quantity of salpêtre any gunpowder, which he was to examine, contained.

This minute is left thus imperfect.

He was then M. A. and afterwards M. D.

And

And he received for answer, that he might easily be resolved in that inquiry, if he took a certain quantity of the powder, which he designed to examine, and steeped it in so much water, as would dissolve all the salt-petre contained in the powder; then filtered the water through cap-paper, and gently evaporated the solution in a broad glass vessel; for by the remaining salt after evaporation he would easily know what quantity of it each pound or barrel of gun powder contained.

He remarked, that there was great difference in the goodness of several salt-petres: that the Dutch petre would waste but four pounds in the hundred; but that English petre would waste eighteen.

Sir WILLIAM WALLER was unanimously elected.

Mr. HOOKE produced two experiments in order to make his theory of fire more evident.

The first was a charcoal weighing an hundred and twenty-eight grains put into a box of iron with sand enough to fill the cavity of the box not filled by the charcoal, and therein screwed up very close by an iron screw-pin. Then it was put into the fire, and there for the space of two hours kept very hot, viz. of a bright red hot. After which the iron was taken out of the fire and suffered to cool; then opened; and the coal being taken out and weighed, was found to have lost but a grain and half of its weight; which was attributed to the moisture, that might be in the said coal when put in. It was farther remarkable, that the shape of the out-side of the coal was not altered, nor any way consumed.

The second experiment was the setting of a crucible full of nitre in a very hot fire; in which it was made red-hot, and the petre was found not to burn till a sulphureous substance was put into it, such as wood, coal, brimstone, or the like, upon the injecting of any of which there were presently produced a fire and flame, by which those substances were consumed. Whence Mr. HOOKE argued, that the nitrous part of the petre was that, which corroded the sulphureous body, and thereby the alcalizate salt of the petre was left behind, and augmented by parts of the coal taken into itself.

February 27. At a meeting of the COUNCIL were present

Mr. HENSHAW, vice-president, in the chair,

Sir JOHN HOSKYNs,

Dr. MAPLETOFT,

Mr. HILL,

Dr. CROUNE,

Dr. GALE.

Dr. BROWNE,

Mr. ALLEN,

Mr. CREED,

Dr. GREW,

Mr. HOOKE.

It was ordered, that Mr. COLWALL be desired to speak with Mr. CHENEY concerning Chelsea-College, and to know from him what farther intentions he has concerning that interest.

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The duty and obligation of the library-keeper was agreed upon under the following heads :

1. The library-keeper shall attend two days in the week, viz. on Tuesday and Thursday ; on Tuesday from nine to twelve ; and on Thursday from nine to twelve ; and in the afternoon from two till the president takes the chair.
2. He shall not lend out any book without an order of the council, or the president or vice-president in the chair.
3. That he shall make a perfect catalogue of the printed and manuscript books after the most usual method.
4. That he shall use no fire nor candle in the library.
5. He shall be provided always of pen, ink, and paper.
6. He shall give such security to the Society for the keeping of the books, as the council shall accept of.

It was ordered, that Mr. Hooke have time till the Thursday following to consider of these proposals, in order to return his final answer : And,

That upon his refusal Mr. PERRY * have the offer of keeping the library.

At a meeting of the SOCIETY on the same day,

The minutes of February 20 being read gave occasion of discoursing farther about the hypothesis, by which the phenomena of the barometer might be explained : and particularly, whether vapours ascending or rain descending through the air change the pressure of the air beneath them with their whole weight.

Upon the mention of saltpetre, Sir JOHN HOOKINS related the manner of making it in the East Indies to be thus : the inhabitants of the bay of Bengal dig small trenches in the earth ; which being filled with water is impregnated with nitrous particles, which being suffered to evaporate in the sun till all the moisture be exhausted, there will be found about the bottom and sides of the trench much saltpetre, which they rake together, and so keep them : and that much was scraped

Mr. HENSHAW observed, that in raking this nitrous salt after this manner, they rake together with the pure salt great quantities of the dross and earth, which are usually sold with it : that there was some of this refined in India ; but that for the most part it was brought unrefined ; and that it was refined in England by the help of some alkalizate salts. Mr. HENSHAW was of opinion, that saltpetre of itself contains no alkali, but that it was produced by fire.

* WILLIAM PERRY, M. A. and F. R. S.

Mr.

Mr. Hooke mentioned the way of making saltpetre with spirit of nitre and alkali salt mixed, whereby it appeared, that saltpetre might be compounded of an alcalizate and an acid salt mixed together, and so coalescing into saltpetre.

Mr. HENSHAW affirmed, that there was a way, by which the whole body of sea salt might be converted into an insipid water, viz. by heating of it very hot, and suffering it to run *per deliquium*; then heating the remainder, the whole body of salt will at last be converted into insipid liquor, much after the manner, in which Dr. DICKENSON had by long circulation converted the $\frac{1}{2}$ of the body of water into white earth.

Hereupon was occasioned a discourse about the cause of the saltness of the sea, some being of opinion, that it proceeded only from the heat of the sun upon the sea in the Torrid Zone, though the greater part were of opinion, that it proceeded from the dissolution of the salt minerals of the earth, either at the bottom or sides of the sea, or brought into it by salt springs made by the rain waters passing through salt mines.

Mr. HALLEY related two magnetical observations, which he had made in his voyage to Saint Helena :

The first was, that the dipping needle lay horizontal at about fifteen degrees on this side of the *Æquinoctial* line :

The second was, that northward of that place an iron being held perpendicular, the lower end would attract the south pole, and southward of it the lower end attracted the north.

The reason of which Mr. Hooke supposed to be, because the northern magnetical pole (as he had formerly shewed at the Society from the examination of the variations observed in captain JAMES's voyage to Hudson's Bay) was placed beyond the pole of the earth towards our horizon, and not between the pole of the earth and us, as Mr. BOND supposed; and because the motion thereof was from west to east contrary to what Mr. BOND supposed; which was, that it moved from east to west : and because that the said pole was within the body of the earth, and not in the air, as Mr. BOND supposed.

The experiment shewed by Mr. Hooke was to shew, that vapours press only according to their own gravity, and not according to the space, which they take up in the atmosphere. This was done by a bladder blown up under water: but the consequences of it not being so evident to some of the members present, it was desired, that some more convenient glasses should be prepared for it against the next meeting.

March 6. At a meeting of the Council were present

Mr. HENSHAW, vice-president, in the chair,

Sir THEODORE DE VAUX,

Dr. MAPLETOFT,

Sir JONAS MOORE,

Mr. HILL,

Dr. CROUNE,

Mr. HAAN.

Dr. GREW.

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It

It was ordered, that Mr. Hooke shall employ such person as he has proposed or the writing letters, as he shall think fit.

At a meeting of the Society on the same day, Mr. HENSHAW, vice-president, in the chair.

The minutes of February 27, being read gave occasion of discoursing farther of the nature of salpêtre.

Mr. HENSHAW was of opinion, that common nitre contains no alcalizate salt, till it is actually produced in it by heat; and that the heat alone without actual burning or inflammation would produce the same quantity of alkalizate salt, as would be produced from it by the burning it with charcoal, sulphur, or the like.

Mr. Hooke conceived, that nitre from its manner of production might be supposed to consist of two kinds of salts united together into one *compesitum*; the one a very volatile and aerial salt rarefied and flying in the air; the other an earthy fixed and alcalizate salt mixed with the earth, by the union of which with one another they become strictly joined into one body, which composes a vitriolate salt.

Objections were made against the supposition, that the sea receives its saltiness from the parts of the earth contiguous to it: and it was said, that there was known but one lake in the world, that yielded salt water, though it is most probable, that, were that the cause, there would be many more found to contain salt water.

The manner of the dipping or inclination of the magnetical needle below the level was explained from the supposition of the magnetism of the earth; and the reason was shewn, why the dipping needle lies horizontal within the Atlantic Ocean at fifteen degrees of northern latitude.

The experiment produced was to examine the gravitation of bodies mixed with the air, but not united perfectly with it. But Mr. HUNT the operator not being able to procure convenient glasses, it was not farther discoursed of till the next meeting.

A discourse was held about gun-powder, aurum fulminans, & pulvis fulminans.

March 13. Mr. HENSHAW, vice-president, in the chair.

Monf. SPANHEIM was admitted fellow.

The minutes of March 6th being read gave occasion to discourse farther about nitre, gun-powder, aurum fulminans & pulvis fulminans. And it was conjectured, that charcoal in gun-powder is of use chiefly upon the account of its containing a good quantity of alkalizate salt, and not so much on that of its being apt

apt to take fire; since it was observed, that pulvis fulminans, which was found to be much stronger, would be kindled without any mixture of charcoal or any other vegetable body. The like, also was conceived to be the cause of the fulmination of aurum fulminans: and much was said about the existence of alcalizate salt in saltpetre. But there being no certain experiment alledged, that cleared that question, it was referred to another occasion.

In order to the better explaining the hypothesis about fire, the experiment of the box for shewing the use of air in burning was again produced; and upon several trials with lighted coals set in an iron grate within the said box, and blowed on with bellows shut up with them, so as only to make the included air circulate and work upon them, it plainly appeared, that the air, after it had been satiated by dissolving and burning the lighted coals, was no longer able or fit to continue that dissolution. But the coals ceased their shining and consuming, and became black, without having any ashes remaining on them: which farther shewed, that the use of bellows in blowing a fire is not the removing of those ashes, as was generally supposed; but the blowing upon the burning body a greater quantity of unsatiated air, which, like a new and hungry menstruum, should more powerfully work upon, consume, and burn the heated body prepared thereby for that operation.

To make this theory yet more plain, another experiment, which had also been produced to the Society, was again shewn, viz. the putting a lighted wax candle through the top of the box into the satiated air within it. And it was by often repeating the experiment found, that the flame of the candle would immediately cease as soon as the wick came within the body of the satiated air, and the steams of the candle ascended without dissolution or shining.

To make the matter yet plainer, the box was opened, after the coals seemed quite extinct, and the fresh air being blown upon the coals with the bellows, lying still in their former posture, they were immediately all of them again rekindled, and appeared to burn and shine as before, and the same candle being then again kindled without, and let into the same box, by the same hole as before, it was not extinguished, but remained burning in the box, as if it had been in the open air.

Dr. GREW produced, &c. ^a.

Marib 20. Mr. HENSHAW, vice-president, in the chair.

The minutes of March 13, were read, which gave occasion to discourse concerning the ingredients of gun-powder.

Mr. HOOKE conceived, that one great cause of the sudden expansion of the

^a This minute is left thus imperfect in the Journal, vol. vi. p. 165.

powder was the operation of the alcalizate salt in the charcoal, that served to compound the powder.

Sir JOHN HOSKINS doubted of this, querying by what means we are assured of there being alcali in coals; and whether it could be thence extracted without actually reducing it to ashes. To which it was answered by Mr. HOOKS, that though possibly it could not be actually extracted in the form of an alcali salt, yet that it produced its effects as much as if it were reduced; as appeared from the effects of it upon iron and copper in reducing them into steel and brass. Besides that the effect of the coal seems manifestly to be the very same with the alcali in the pulveruluminous, which is made of nitre and sulphur in the same proportions, as in gun-powder, and differs only from it in having an alcalizate salt mixed with the other ingredients instead of powder of charcoal; and that the sudden expansion in each of them was occasioned by the salts working one upon the other in the way of dissolution; that DES CARTES's hypothesis of the turbinated motion of the nitrous parts is not sufficient to account for the effect; nor was there any ground to believe such a motion.

Sir JOHN HOSKINS urged, that as there was very little alcali to be extracted out of a small quantity of coal any way, and so it was not likely to be the cause of so great an effect, is that even of that which was, a great part of it would be left behind, after the gun-powder was fired in a musket-barrel or the like; so that it should rather seem, that the alcalizate part is useless and insignificant, it being none of the parts, that expand and fly away.

Hereupon it was mentioned, that ROGER BACON in a book of his called *De mirabili potestate Artis & Naturæ*, had manifested by an enigmatical description thereof, that he well understood how to make gun-powder, or a composition, which should perform the same effect: for in the edition of that book by ORONTIUS FINES in 1522, p. 44, he says: "Præter hæc vera sunt alia stupenda naturæ; nam soni velut tonitrua possunt fieri in ære, immo majore horrore, quam illa, quæ sunt per naturam. Nam modica materia adaptata ad quantitatem unius pollicis sonum facit horribilem, & coruscationem ostendit vehementem. Et hoc GIGANTIS, qui linguiculis fractis & exercitus destruitur ad modum artificii fabili Mædinatorum destruxit lampadibus, igne saliente cum fragore inelæc, si quis sciret uti ad plenum in debita quantitate & materia." And p. 52. "Item solum sic, sed tamen satis petreæ LVRV Vo RO Po Vir Can Veriet sulphuris; & sic facies tonitruum & coruscationem. Sic facies artificium. Vi deas tamen utrum loquor in ænigmate vel secundum veritatem."

It was desired by that Society, that as many books, as could be procured of the said ROGER BACON, should be perused; and it was wished, that they were all collected and printed, as being supposed to contain very many curious and useful matters.

Dr. GALE affirmed, that he had collected as many of the works of this author, as

as he could procure; and that his copy was that of Dr. LANBAINÉ, who had been very diligent and curious in that respect. Dr. GALE remarked likewise, that the king had a book of ROGER BACON out of Dr. PRIDEAUX's library, called the *Opus Majus*; and that his book of the prolongation of life, which was supposed to be lost, was affirmed by Dr. PLOT to be in the Bodleian Library; Dr. GALE adding, that he had the same book.

Dr. PLOT was desired to inquire what other works there were of BACON besides those in the possession of Dr. GALE, who affirmed, that his collection was full as good as that of Dr. MARSH at Dublin, whose copy of BACON's works was supposed to be the fairest extant.

Dr. PLOT mentioned, that there was one book of ROGER BACON in the library of University-College at Oxford, which he thought to be no where else in the world; and that Dr. LANBAINÉ had made an epitome of all the contents of the works of that writer, as he had also of all the manuscripts in the Bodleian Library.

Dr. GALE promised to lend his copy to Mr. HOOKE to peruse, when he should call for it.

After this the discourse was about fire, flame, heat, &c. and several objections were made against Mr. HOOKE's hypothesis of explaining it by the dissolution of bodies by the air. It was supposed, that the fire went out when all the pores of the air were filled so, as there was no more space left for the vapours and smoke to fly out of the coal. To which he answered, that the want of room could not be the cause of the extinction of fire, because if the air were drawn out of the vessel, wherein a candle or coal were burning, it would yet sooner go out; where-as there was thereby manifestly made more room; and upon the forcing and compressing more air into a vessel, the fire would continue so much the longer burning.

Dr. CROWE supposed, that the spring of the air * * *.

Dr. HOLDER was of opinion, that the smoke is lighter than the air whilst dry; but that meeting with the moisture of the air it is precipitated down again, being made heavier.

The experiment of the sand falling in water, in order to examine how much the pressure of the water was altered thereby, was tried; but Mr. HUNT being unable to blow down to the bottom of the tube, it could not be certainly observed.

The same and another experiment were desired to be shewn at the next meeting.

* This minute is left thus imperfect in the Journal, vol. vi. p. 168.

1679. March 27. Mr. HENSHAW, vice-president, in the chair.

The minutes of March 20 being read gave occasion to discourse farther concerning the works of ROGER BACON; and it was judged very desirable, that all his works might be printed together; but that before this undertaking were begun, all imaginable care should be used to inquire what parts of his writings may be dispersed in private libraries more than are to be found in the public; as his *Comutus Narration* is in the library of University-College, and not in the Bodleian.

Mr. AUBREY affirmed, that Mr. Wood in his English edition of the antiquities of Oxford had given a more particular account of ROGER BACON's life, and had inserted a catalogue of his works.

Mr. AUBREY was desired to write to Mr. Wood to send his catalogue of ROGER BACON's works.

He proposed, that there might be a catalogue made of all the books and treatises written and published by any of the members of the Society, which might then be more easily done, than if it should be omitted too long.

Dr. PLOT thereupon proposed it as a thing very desirable, that a general catalogue might be made of all the manuscripts, that could be found in England, whether in public or private libraries.

Dr. GALE moved, that Mr. HOOKER might peruse the epistle of ROGER BACON to Pope CLEMENT, and take notice of what was considerable about any invention supposed to have been the product of a much later age; since in that epistle, as Dr. GALE conceived, is the epitome of all his inventions mentioned elsewhere in his works: and that therefore Mr. HOOKER might soon see what might be expected.

Dr. PLOT was desired to collate it with the Oxford manuscript.

He observed, that there was in some part of ROGER BACON's works mention made of a way of blowing up a ship, that had been sunk, which was by combustion like gun-powder, and so setting fire to it.

Mr. HENSHAW related an experiment of making a piece of iron red hot by hammering, which was, that a small bar of iron about the bigness of one's finger forged to a small point, and then very nimbly hammered on an anvil, would by the continuance thereof be made red hot without the help of any other heat.

Mr. HILL proposed, that it might be tried, whether any thing either natural or

* This English edition was never printed.

artificial

artificial would burn in or under water. To which Mr. Hooke answered, that this effect might be performed with gun-powder.

April 3. Mr. HENSHAW, vice-president, in the chair.

The minutes of March 27. were read, which gave occasion to discourse farther concerning the writings of ROGER BACON.

Dr. GALE produced a paper containing an account of an experiment pretended to be made by the said ROGER BACON, with a hazel rod, as it was described out of a part of his works, called *De Motu Naturali Mirabili*, viz. "Surculus unius anni suscipiatur, qui oritur juxta radices coryli, & secundum ejus longitudinem dividatur, & separentur partes divisæ per spatium palmæ seu quatuor digitorum; & unus teneat ex una parte extremitates duarum partium, & alius ex alia parte similiter; & semper teneat æqualiter & leviter, ita quod sicut partes in toto fuerant contra se posite, sic teneantur infra spatium dimidii milliaris; incipient partes virgæ sibi appropinquare paulatim, sed fortius in fine, ut tandem omnino concurrant & sint simul, extremitatibus tamen excurrentibus diversis; quia per violentiam detinentium præpediuntur: & est hoc valde admirabile."

Mr. Hooke was desired to consider of that paper, to see if he could explain the meaning thereof.

Mr. AUBREY was desired to write to Mr. ANTHONY WOOD, to understand from him what account he designed to publish of ROGER BACON in his history of the antiquities of Oxford, now printing in English.

Mr. HILL mentioned a manuscript of ROGER BACON in the possession of Dr. WINDET, intitled, *De Diffis & Falsis falsorum Mathematicorum & Dæmonum*.

The vice-president was of opinion, that the catalogue of his works was not proper to be printed, till a farther search had been made.

Mr. MOSES REUSDEN, recommended by Mr. EVELYN, sent in to the Society a treatise of his of the nature of bees, intitled, *Monarchy founded in Nature, and proved by the History of Bees; shewing their admirable natures and properties, their monarchical governments, and their wonderful generation; with a discovery of improving them, by taking their honey without destroying the bees; with particular direction for keeping them in colonies.* By Michael Reusden, apothecary, bee-master to his majesty: dedicated to the king's most excellent majesty.

The contents of the several chapters being read, the author was called in, to know what his desires were, which he expressed to be, to have his treatise perused by the Society; and that, if they should think fit, upon their scrutiny and exa-

* JAMES WINDET, M. D. author of the book *De Fide sanctæ scripturæ*.
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mination thereof, they would grant him a license for printing it. Being asked several questions, he answered concerning his experience, that he had made many observations and experiments on bees for four years past, after this new way: That the bees slept almost all the winter, and did not spend upon their flock. That he had read Mr. BRYAN, and divers other authors, about bees: and that in what particular he differs from them, he assigns both his experiments and reasons for so doing. He was willing to leave his book with the Society for their perusal, and was appointed to come again at the next meeting, it being recommended to Dr. CROWE to peruse the book, and to give his opinion of it.

A farther discourse was held concerning ROGER BACON, and Dr. GALE produced the following extract from his own manuscript, p. 684 of that writer, in *arte experimentalium*, containing the description of gun-powder: "1. Quædam experimenta tantum terrorem visui incident, quod corruptiones nubium longe mirus & sine comparatione perturbant; & experimentum hujus rei capimus ex hoc ludicro puerili, quod fit in multis mundi partibus, scilicet, ut instrumento facto ad quantitatem pollicis humani ex violentia illius salis, qui sal petra vocatur, tam horribilis sonus nascitur in ruptura modicæ rei, scilicet modici pergameni, quod fortis tonitruū sentitur excedere rugitum, & corruptionem maxime fulminis jubar excedat."

Mention also was made of his way of blowing up sunk ships.

Sir JONAS MOORE said, that the way of blowing up ships by gun-powder, to which fire was conveyed under water, by means of a pipe, and a train-match, is now frequently practised, as it was heretofore practised at Woolwich and Sheerness.

He related also an observation of his about red-hot bullets shot out of a gun, that the said bullets continue as red-hot as they were that till they fell; which he conceived to be caused by the swiftness of their motions through the air. This, he said, was observed at Hull.

Mr. HOOKS mentioned his observation of the melting of a small particle of steel struck off by the violence of the stroke of a flint; the heating of iron by filing, hammering, grinding, rubbing: that the dust thrown off from the grinding-stones in grinding knives, razors, and the like, are melted globules of the steel: that the particles of flints and other hard stones upon striking one against the other will grow red-hot and thin; as will also a tobacco-pipe clay, and several other clays and earths hardened by burning.

Mr. HENSHAW observed, that the iron heated red-hot by hammering must be small; otherwise the experiment would not succeed.

Sir JOHN HOSKINS said, that Mr. LAWSON had lighted a pipe of tobacco by an iron bit heated by hammering.

[Mrs.

Mr. Hooke related, that he had fired a gun-powder serpent, which had burnt under water, and came out again burning after it had passed through a good space of water.

A discourse then arose about substances burning in water, as camphire, naphtha, petroleum, &c.

Dr. HOLDER related, that sometimes rivers had been guarded by petroleum swimming upon the water; for that any part of it being fired, it would all of it presently take fire, and set fire to the ships swimming in it: and that the king of Achin was said to have made use of it.

Sir JOHN HOSKYNs related, that the steam of the varnish used by cabinet-makers would sometimes take fire, and had been observed to run along till it set fire to the varnish in the vessel.

Mr. Hooke related, that he had observed something of this nature of oil of turpentine; which being mixed with an acid liquor, set it into a most violent fermenting, heating, and smoking, insomuch that it could not be endured in the room: being set in the chimney corner, where a fire was, the smoke immediately caught fire, and burned with a blaze almost a yard high.

Mr. SLARE presented the Society with a phosphorus of his own making, affirming it to be a compound substance, and not like the Bononian stone. This was examined by several present, and judged to be as good as any, which they had seen.

Mr. HAAK presented to the Society for their library five small books sent to him by CHRISTOPHER STURMIUS, professor of mathematics and philosophy at Altorf; viz. 1. *Dis. . . . de Mathematicis*. 2. *De Autoritate interpretum Naturæ ac speciatim Aristotelis*. 3. *De Clepsidrarum phænomenis Et effectibus*. 4. *De Cartesianis Et Cartesianismo*. 5. *De Visonis Organo Et Ratione*.

He presented also to the Society for their repository some papers of salts and sulphurs, which Mr. GEORGE TRUMBALL had taken up and brought from the top of the pike of Teneriffe.

Dr. GREW produced some salts, which he had extracted out of the waters about London.

He likewise communicated several anatomical observations, with the following account of them;

1. *Placenta Uterina Muliebris*, excarnated; that is, with the blood and smallest capillary vessels cleansed away: together with a certain glandulous substance of a yellowish colour being the true parenchyma, by the means of which the serum or lymphous part of the blood seems to be separated into the membranes of the secundine.

2. The uterus of a bitch, in which the os internum was of a very peculiar structure, being a nervous caruncle opening with four little lips cross-wise; that is, not horizontally, as in other animals, but perpendicularly; whereby the passage from the uterus is made more difficult. From which it may be, as from one cause, that a bitch is seldom or never known to bring an abortive birth.

3. The guts of a cassiowary with the stomach and crop, or rather the guls; this and the rectum being bigger than in a horse, the stomach on the contrary proportionably small, and only membranous, not gristly.

4. The diaphragm of a cat, divided into two muscles by two narrow membranes, being two semidiameters, and having a third round one in the centre, all three answerable to so many tendons; by which upon every respiration the diaphragm is made to stand tensed and tite like the parchment of a drum.

5. A cat's tongue, which is all over not only rough, but sharp with bony thorns, standing as the teeth or wires in a wool-card. So that a cat carries her curry comb in her mouth, only using her tongue to scratch which, where a dog uses his teeth or claws.

6. The crystalline humour of a cat's eye, which in drying breaks every where from the centre of both convexities in regular triangles.

7. The foremost teeth of the upper chop of a rabbit, which are four. The two outmost are the incisives, common to this and some other animals; but within these are two more very peculiar, which may be called the page-teeth; because they hinder the other teeth from striking too far, so as either to dislocate the chop, strain the muscles, or cut the gums; which might otherwise easily happen in this animal, because the fore-teeth are so sharp and chisel-wise, and because it cuts or chops its meat so quick. And to serve the better for the same purpose, the said teeth are not made sharp, but flat headed.

8. The fore and hinder-feet of a rat, together with those of a mole; which being compared shewed the exactness of their contrivance for the use of those animals, the hinder-feet of a rat being at least three times as big as those before, because he often makes strong and high leaps; those of a mole three times less, because he works only with his fore-feet.

9. The bony tendons of the leg of a cock, which are also in other fowls, being necessary to keep the standing posture more steady, as that, in which they keep, as well asleep as awake.

Mr. Hooker shewed an experiment in mechanics, which was a way how to take notice of all the rain, that falls, and was designed as a part of the weather-clock. The contrivance of this invention was the suspending the bucket, that was to receive the quantity of rain, that falls at any time (whether more or less) so that according to the quantity therein contained, the place where it should either be

be higher or lower; but certainly determin'd. This was performed by a counterpoise to the said bucket. The counterpoise was contriv'd two ways, either by a string of leaden bullets so order'd, that when the bucket was quite empty, all the bullets rested upon a table; but when there fell as much water into the bucket, as equalled the weight of one of the leaden beads, then the bucket descend'd one space, and one bullet was lifted up; and when twice as much, two bullets, and when three times as much, three bullets were lifted, and so forward, till all the bullets were lifted up, and the bucket had descend'd to its place of emptying; whereupon the chain of bullets presently descend'd and lifted up the bucket into its empty place. But because this motion proceeded with jumps,* and was not continually equal, therefore a second contrivance was also shewn; which was this:

The counterpoise to the bucket, when empty, was a cylinder immerst into water, mercury or any other fluid; which cylindrical counterpoise, according as the bucket received more and more water, was continually lifted higher and higher out of the water by spaces, always proportioned to the quantity of water, that was contained in the bucket. And when the bucket was filled to its designed fulness, it immediately emptied itself of the water, and the cylinder plunged itself into the water, and rais'd the bucket to the place, where it was again to begin its descent.

This contrivance here made use of was declared to be useful for making a new and useful beam for examining the weight of bodies without any trouble of adjusting, the rising of the cylinder immediately shewing the determinate weight of any body put into the scale without any farther trouble.

April 10. Mr. HENSHAW, vice-president, in the chair.

Upon reading the minutes of April the 3d, a discourse was occasioned concerning the time, when guns were first invented and brought into use: and it was observ'd by Mr. HENSHAW, that when they were first used, a bow was joined to the same stock, which served for the musket, and thence it was called by Mr. NAME *Arctubugio*. These were used in the time of king HENRY V. which was long after ROGER BACON's time.

Hereupon it was debated, whether SWARTS were the first inventor of gun-powder, or only of the method of making use of it in guns; and whether he were not rather the inventor of guns than of gun-powder; since it was plain from several passages in ROGER BACON's works, that not only that writer was not ignorant of the way of making such a powder, but that even the powder itself was very commonly known and commonly made use of for making fire-works, not only by boys here in England, but generally in most other places. It was therefore desired, that inquiry might be made into the times of their living.

Mr. HOOKE remark'd, that though they had not gun-powder, yet that by the help of great springs they were able to do very great things: that besides divers other

other springy bodies, they know the use of the spring of the air, as is evident in Hero's works, especially in that mentioned by Vitruvius for the quenching of fire.

Dr. ALLEN mentioned, that CÆSALPINUS had given a good hint for the circulation of the blood, and was alledged by some, as if he had been the first discoverer. But his concluding his discourse with a query, what became of the blood after it had come into the right ventricle of the heart, plainly shewed, that he understood not the true circulation of the blood since found out by Dr. HARTZ.

Mr. HENSHAW gave an account of some trials, which he had made with the phosphorus presented by Mr. SLARK. One of which was, that he had found, that it would receive a very brisk light from the evening light of the air, but a very dusky one from that of a candle, and none sensible from the rays of the moon. It was desired, that he would try to increase the light of the moon by a burning-glass, to see whether it would produce any considerable effect.

Dr. CROWE mentioned, that in BARTHOLINUS's *Alia Medica*, there was mention made of two liquors, which being put together produced flame.

Dr. ALLEN read a short account of some extractions made by himself out of medicinal waters near London, viz.

"August 1, 1663. I distilled six gallons of Chigwell water, out of which I extracted of salt 3x—3ß, and there remained of calx ʒi. and ʒij.

"I extracted out of the like quantity of the * * waters by evaporation 3xi. and ʒi. of salt and ʒij. ʒ. of calx.

"There was of the said salt extracted by evaporation crystallised ʒi. ʒ. I extracted out of three gallons of North Hall water of salt ʒij. of calx ʒij. and ʒij. and from three gallons of Barnet water of salt ʒi. and ʒvii. ʒ. and of calx ʒij. and ʒ. ʒ."

Mr. HENSHAW observed, that the best way of extracting a salt was by first purifying the water, letting it stand by itself, and then distilling it.

He added, that some salts are extremely penetrating, so as to pierce through the substance of the pipkin: and that he had observed, that horse-dung would send a volatile salt quite through a wall of four inches thick, which would shoot and grow on the other side into a kind of nitre.

Mr. HOOK shewed his experiment, being an hygroscope made of several short gut strings, or any other shrinking body sensible of the moisture and dryness of the air. These were united together by the means of iron wires made after the manner of beams, that the shrinking and swelling of every one of them was communicated to the last, which moved the index, by which means the least variations

tions of the air, as to dryness and moisture, were made very sensible, and the contrivance of it was so ordered, that the least degree of power, which it had to stretch or shrink the string, would easily move and make a sensible alteration.

Some objected, that gut strings would in process of time lose the power of shrinking and stretching, and so were unfit for such a work. But it was answered, that those strings were not intended for a constant hygroscope; but only for the present use, to shew the manner how to make use of these, or any other shrinking or swelling body for the shewing of the effect desired: and that at the next meeting there would be one of another substance produced, that would not be liable to those objections.

April 17. Mr. HENSHAW, vice-president, in the chair.

Dr. GALE produced some of Dr. Plot's queries and other papers, which were dispersed among several members of the Society present, who had not them before, and were desired to consider them, and promote the design as much as they could.

After which the minutes of April the 10th being read, and the Society discoursing farther concerning the time of inventing gun-powder and guns, Sir JOHN HOSKINS mentioned the picture of an old musket in the hangings of the prince's chamber near the house of lords, where one holds the gun while another gives fire to it. He added, that KIRCHER in his *Mundus Subterraneus* had collected most things concerning guns and gun-powder.

A book of ROGER BACON was produced, called his Epistle, which was published by Dr. DEE. It seemed to be on the same subject with his epistle to pope CLEMENT IV. but very much short of that in the possession of Dr. GALE. It was desired, that that epistle in the hands of Dr. GALE might be perused, to see, whether it were fit to be printed, as preliminary to his other works, as seeming to contain an account of all his other writings, which were thought very considerable, and might prove an honour to the English nation; especially as he appeared to be the first, who had begun experimental philosophy. Dr. DEE remarked, that he lived about the year 1240: but Dr. CROUNE observed, that who was tutor to ROGER BACON lived in the time of king EDWARD I.

Dr. CROUNE gave an account of Mr. REUSDEN's book on bees, which he had perused; that the part of it about the education of bees contained many good observations well made and related; but that what the author said about the king-bee and its sperm, out of which he supposed the bees to be produced, appeared to be mere fancy, and was contrary to the opinion of other writers.

That as to the diseases of bees, JOHNSON affirms, that they will fall into a diarrhoea, and wear away by it.

Mr. HOOKE shewed his experiment, which was a way of making an hygroscope with pieces of elm cut across the grain, the better to be able to be sensible of

of the changes of the air, so contrived as to make the fanne as much and large as should be desired. That produced by him consisted of twenty-four feet of the said pieces, and might be made of an hundred or two hundred feet of the said pieces, and yet so ordered, that the shrinking and swelling of every foot of it was made sensible, and accumulated all in the last. He was desired to complete this invention for the weather-clock, which was now near finished.

Dr. GREW read and delivered in a paper of the things, which he had shewn at the meeting of April 3. which paper was to be inserted in the Journal-book of the Society.

April 24. This being Easter week very few of the Society met.

Dr. GREW having some part of his catalogue of the repository fitted for the press, proposed to read it at this meeting, which accordingly at the desire of the members present he did, after the minutes of April 17th had been read.

Sir JONAS MOORE, the vice-president, took the chair; and as soon as Dr. GREW had read his observations *De Homine*, without at all entering into the debate of the matters, the Society rose.

May 1. Mr. HENSHAW, vice-president, in the chair.

A letter from Sir PETER WYCHE, directed to Mr. HENSHAW, dated at Ham-burgh, April 18, 1679, was read, giving an account of a packet of letters which he had received from Sir JOHN PAUL, and conveyed by one JOSHUA JOHNSON; offering likewise to serve the Society to the utmost of his power in those parts.

The letter and packet of Sir JOHN PAUL being received and communicated to Mr. PITT was likewise produced.

The letter gave an account of his endeavour to procure from Mr. president RESEN his collection of new maps and descriptions of Denmark, desired by Mr. HENSHAW, in order to their being inserted in the first volume of the *English Atlas*, publishing by Mr. PITT.

With this letter came a packet from Mr. RESEN, containing first his letter, in which he gave an account of his whole undertaking in general, for the particulars whereof he referred himself to the other papers, which were then in Mr. PITT's hand, and declared himself willing to part with the whole work, now almost ready for the press, at the same rate, which it had cost him, viz. two thousand seven hundred six dollars. It was desired, that Mr. PITT should be consulted with on this affair, that so Mr. HENSHAW might return Mr. RESEN an answer suitable to the civility proffered in his letter.

Together with this letter were shewn two of Mr. RESEN's maps, the one of the island of Gothland, and the other of the island of Borringholms, both very particularly

ticularly and curiously described: as also the first sheet of a discourse of ERASMUS BARTHOLINE, in the press, intitled, *De Aeris Ignis Differtatio*, giving an account of the situation and air of Copenhagen.

Dr. GREW then read a part of his description of the repository, being his chapter about animals and animal substances therein kept.

Mr. HOOKE produced his new way of ordering pieces of elm for the making of an hygroscope: upon which it was desired, that there should be one of this kind prepared to stand in the meeting-room of the Society: as also that a barometer, alter Mr. HOOKE's way, should be prepared for the said room.

May 8. Mr. HENSHAW, vice-president, in the chair.

He returned the phosphorus presented by Mr. SLARE, and gave an account of some trials made therewith. Among many others it was very remarkable, that by several trials he could not perceive, that the light of the moon had any sensible operation upon it at all, though he had tried it to the best advantage. And Mr. HOOKE suggesting, that possibly by collecting the radiation of that body by a burning-glass, it might have some sensible effect of the stone, it was desired, that he should make trial thereof between that and the next meeting, and give an account of it.

The maps and ground-plots of several towns in Denmark sent by Mr. RESEN to Mr. HENSHAW were produced and shewn.

Dr. GREW read a section of his discourse and description of the repository.

Mr. HENSHAW observed by the way, that rivers, which are much frequented by crocodiles, have their water made so offensive by their musky smell, that they cannot be made use of by the inhabitants for drinking.

Mr. CRISP related, that in some of the rivers of Africa, where the Gambia company trade, crocodiles are so frequent, that twenty or thirty sometimes will follow a bait upon those rivers.

Sir JOHN HOSKYNs mentioned an old statue at Rome of the river Nile, where men were carved killing of crocodiles.

Several queries were made concerning the rattles of rattle-snakes, whether they were the epiphysis of the tail-bone, or the end of the skin cast off every year?

As also concerning the unicorn's horn, whether it were the horn or rather the tooth of the fish caught about Greenland?

Mr. HOOKE produced and read a paper, containing a description of the way of flying, invented and practised by one Mons. BESNIER, a smith of Sable in the Vol. III. county

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county of Mayne, the contrivance of which consisted in ordering four wings folding and shutting like falding *, to be moved by his hands before and legs behind, so as to move diagonally, and to counterpoise each other: by which he was, it was said, able to fly from a high place cross a river to a pretty distance.

Dr. CROUNE remarked, that in the Paris Gazette there was mention made of one, who had lately flown there from the top of a steeple to the ground at a considerable distance, and had lighted safe.

He observed likewise, that the bodies of fowls were made in all parts light and strong, and particularly in their bones.

Mr. HOOKE produced a model of the contrivance of the wings made with past-board, whereby both the manner of the motion of them diagonally, and also of their opening and shutting, was explained; though he supposed that not to be the best way contrived for the performing that effect after that manner, but that the same sort of wings might be much more advantageously made and used for that effect.

Sir JONAS MOORE related, that one Mr. GASCOIGNE had, above forty years before, made a contrivance for flying, by which he had been able to make a boy at Knareborough fly a considerable way; but that he being frightened in his flight by the acclamations of the spectators, fell down before he designed to alight, and though not much hurt, would not attempt it any farther.

Mr. HENSHAW conceived, that by reason of the weakness of a man's arms for such kind of motions, it would be much more probable to make a chariot or such like machine with springs and wheels to move the wings, that should serve to carry one or more men in it to act and guide it.

Several relations were mentioned of the strength of the wings of fowls, and amongst the rest, Mr. HENSHAW took notice, that he had known a man of fifty years old beat down by the stroke of the wings of a swan.

Mr. DANIEL COLWALL presented to the Society for their repository the pizzeles of an unicorn fish.

May 15. Mr. HENSHAW, vice-president, was present, but the Society did not sit.

Mons. ROMER of the royal academy of sciences at Paris was admitted to be present, while Dr. GREW shewed some anatomical observations, and left the paper describing them to be inserted in the Journal.

1. The skin of a man's head, and part of that of the arm, both tanned, making almost as tough and firm leather, as that of any cow's hide.

These

These two pieces compared together shewed the thickness of the skin in the hinder part of the head and neck especially above what it is in other parts, the better to secure the brain and spinal marrow from cold.

2. Part of the membranes of the abdomen of a flying squirrel, which is all the muscles, which that animal hath there to make him the lighter for his high leaps and falls.

3. The prickles of a hedge-hog, the fibres of which give them their strength and stiffness, standing all round in the circumference as in a wheaten straw; in the middle spongy like a quill or soft pith, for the greater lightness.

4. The foremost and hinder claws of a cat; the latter but four, the former in number five; the latter very blunt and broken-pointed; the former always as sharp as needles, very like in shape to the claws of a tyger.

5. Part of the pia mater of a bull's brain duplicated between the cerebrum and the cerebellum, being half an inch thick.

6. The tongue of a trout, whereon there are four sharp hooks, two on each edge, so that this fish may be said to angle with his tongue.

7. The bony fibres of the chap-muscles of a lobster so made for greater strength and steadiness in apprehending the prey.

8. Stones out of a woman's gall, always angular, as here, and not round, as the bezoar is.

9. Two bones taken out of the heart of a cow, which seemed to be as hard and white, and therefore as full of volatile salt as those in a stag's heart: of what special virtue it was no certain experiment had been made.

10. The weafand of a cassawary, together with the tongue.

This gave an ocular demonstration of a mistake of ALDROVANDUS, who affirmed, that this animal hath no tongue; and to whom Mr. WILLUGHBY also in his *Ornithologia* seemed to assent.

In this weafand the rings were entire, but cartilaginous, and very soft.

At the bottom of it towards its division into the two lobes of the lungs are two muscles, one on each side, which serve to put it down, or draw it on one side or the other, according as there is occasion to give way to the descending meat or the gorged stomach.

11. The weafand of a Japan peacock.

At the lower end thereof are a pair of muscles for the same purpose as in a cassawary.

The rings are intire, and hard and bony.

At the upper end next the epiglottis is a ridged prominence in the middle.

12. The weafand of a dog, wherein the rings are not intire, but their ends joined by a membrane, which runs through the length of the weafand.

By these compared together it appeared whence in part these and other animals have either a tunable, that is, variable voice, or how a strong one. That of a dog is variable, partly because the rings of the weafand not being intire are dilated or contracted, according as the dog's voice is bigger or smaller.

That of a Japan peacock is little variable, because the rings being intire can neither be dilated nor contracted; yet it is very strong and loud, because the rings are not soft, but hard and bony, the prominence above-mentioned adding also to the shrillness of the sound.

That of a cassawary is neither variable nor loud, because the rings are both intire and soft.

13. The kidneys of a cat in two figures: the former shewing the inosculations of the vessels or veins on the outside, the coats being taken off; the other the inner part of the kidney, cut down the middle length, shewing the three distinct regions of the kidney, viz. the glandulous, the fibrous, and the middle, where the glands, fibres, and vessels, all meet together; being a curious mechanical contrivance for the separation of the saline serum of the blood from its oleose parts. For by the vessels or arteries the blood is brought to the middle region, where the glands and fibres meet, and are mixed; the saline serous part is readily received, or imbibed by the lean fibres, and by them carried off into the pelvis; the oleo- and gummosus part by the fat or unctuous glands, and by them is discharged back into the veins.

14. The skulls of a weasel and polecat.

15. The skull of a fox.

16. The skull of an owl.

17. The skull of a rabbit.

In which, among other things, is observable the various opening of the ear. In a polecat and weasel it opens level and forward, the concha being prominent just behind, as most proper for these animals, that seek their prey or food neither above nor below, but on the ground. In a fox it opens also forward, and the bone prominent behind, but obliquely downward, the better to cast into the ear a sound, that comes from above, proper for his watching of fowls, at rout. In an owl it opens

opens also forward, and is prominent behind, but obliquely upward; proper for his taking of any noise below him, as he sits in a tree, or is perched elsewhere. Contrary to all the rest, a rabbit's ear opens backward, having a sphen or cubular bone about a quarter of an inch long, reclinated or pitched obliquely backward on the entry of the tympanum, made proper for the animal to hear all noises, as he stands ready for flight. And it is observed, that a rabbit always hearkens with his breech towards you.

18. The skull of a cat, in which the hardness of the concha above what appears in the same bone of many other animals is observable; as also its thinness, whereby there is made a very strong repercussion of the sound, so that it seems, that this animal hath a quick ear.

The cranium of the cat is divided perfectly into two rooms, one for the cerebrum, the other for the cerebellum: whereby perhaps this animal's brain is more secure from turnings, as we say; that is, the cerebellum pressing on the cerebrum, as the runs along very high and steep places.

The atlas of a cat hath a *processus dentiformis* contained in the cavity of the next vertebra by a strong transverse ligament.

The bone over the cerebellum of a fox is like a curious canopy in the shape of a scollop shell: Here also is observable the amplitude of the temporal muscles by the standing out of the bones to give way to them.

The great and upper teeth also of a fox have a triple indenture; those of a dog but a double one.

It is likewise observable, that the long teeth in a fox or dog are so placed, and the jaw so shaped, that the great ones only meet; these never, lest upon the breaking of bones they should break or loosen one another.

Mr. HOOKE gave an account of his trials made with the phosphorus of Mr. SLARE, that having exposed it for several minutes to the rays of the moon at full and near the meridian, he could not perceive the least appearance of light, though carried into a very dark room; and that he was not able to find any effect of the light of the moon, tho' cast upon the phosphorus by a large reflecting burning glass: which agreed with the observations made of the same by Mr. HENSHAW.

The experiment designed to be exhibited by Mr. HOOKE being an experiment of light to be shewn by the rays of the sun, could not be performed by reason: that the afternoon proved cloudy.

May 22. Mr. HENSHAW, vice-president, in the chair.

The minutes of May the 8th and 15th were read: whereupon the cause of the faintness of the beams of light reflected from the full moon were farther discoursed of.

of, upon the occasion of their not producing any sensible effect upon the new phosphorus.

Dr. GREW read the third part of his description of the repository, being about the flying animals there kept.

Dr. PLOT mentioned an invention made by a person in Kent, which was a kind of clock made by the passing of fine sand through a small hole somewhat after the way described by BELFORIUS.

Hereupon mention was made of divers other ways of making hour-glasses or clocks, viz. by the passing of the air, inclosed by an instrument, through a very small hole.

A stranger being present, the weather-clock now finished by Mr. HOOKE was omitted to be shewn till the next meeting, when it was to be carried to Mr. HUNT's lodging, that he might attend it and supply it with fresh papers.

Mr. HOOKE then had leave to introduce Monsr. PAPIN, a gentleman, who staid in the outer room with an intention to shew an experiment to the Society, which was singular and new.

He being brought in, shewed a small glass, which he had in his pocket, wherein were contained several small pieces of hartshorn, which he had softened by a new way, that he had found out, of boiling them. These pieces were examined by cutting and biting, and were found to be not much harder than a sticky and feeded carrot-root.

He affirmed, that he had a method of softening other bones also by boiling and likewise ivory.

Being demanded, whether any of the substances so softened would by keeping, or any other way, that he knew of, be again hardened? he answered, that he was not sure of that effect; though he thought, that these substances, which were thus way softened, could scarce be reduced to their former solidity.

He was desired to try what effect this kind of boiling might have upon barley, wheat, malt, or the like for making liquors: as also, to let the Society see an experiment of its effects upon other kinds of bony substances, and flesh; which he promised to do.

May 29. Mr. HENSHAW, vice-president, in the chair.

Monsr. PAPIN, as he had been desired at the last meeting, produced three glasses of liquors made by his trials upon wheat, barley, and malt, boiled after his new way, to see what effect it would have on liquors. They were found to be very strong

(strong tinctures of those substances; but being but small quantities, and not fermented, little could be determined concerning them.

The minutes of May the 22d being read, Mr. HENSHAW produced a piece of the hartshorn, which was so very soft at the last meeting, and was now hardened again to a very great degree, and very white: but upon scraping of it, it was observed to be much more brittle than common hartshorn, the greatest part of the glutinous gum thereof having been fetched out of it by the boiling. Nevertheless it was supposed, that this, as also ivory, might be very useful in mechanical matters, by reason of its easiness to be carved and shaped when soft, and its hardening again so quickly to so great a degree with whiteness.

Query, whether it might not be dyed into various colours, when so softened, or after it is again hardened.

Mons. PAPIN then produced some calves feet dressed after the same manner; which being examined, were found to have the bones thereof softened, as the hartshorn was at the last meeting, and the flesh thereof was notwithstanding very well tasted, and as firm as if boiled the common way. He was desired to communicate to the Society what farther prosecution he made of this his new invention.

Dr. GREW produced and read two letters, the one from Dr. COLE, the other from Mr. RASTELL inclosed in the former, containing a description of the way of making salt at Droitwich, in answer to the queries, which had formerly been sent to Cheshire; together with the quality, virtues, and uses, of that salt, brine, and salt-spring.

Mr. HOOKER read a translation of a chapter of the Italian book of father FRANCISCO LANA, intitled *Prodromo*, being an explication and demonstration, as he supposed, of a way to make a vessel to swim and float in the air, so as to carry in it one or more men with other heavy bodies, invented, as he says, by himself, in order to make flying practicable, which had before been thought impossible *.

Mr. HILL produced from Mr. THOMAS CRISPE a parcel of grain gold, which Mr. HOOKER having examined with a microscope, found to consist of small bulks of very irregular figures; but that most of them seemed to have been melted, all the angles of them being round and swelling, and not at all like the angles of sand, which are sharp; and it was conceived, that the same kind of figures would be produced, if the gold, when melted, were dashed into a heap of sand.

The Society then went to take a view of the new weather-clock, which was set up in Mr. HUNT's lodgings, made to keep an account of the quantity and time of all the changes, that happen in the air, as to its heat and cold, its dryness and moisture, its gravity and levity; as also of the time and quantity of the rain,

* See Mr. HOOKER'S Philosophical Collections, n^o 1. p. 18.

(snow,

snow, and hail, that fall: all which it fets down in a paper, so as to be very legible and certain.

June 5. Mr. HENSHAW, vice-president in the chair.

Mr. HOOKS mentioned, that he had seen a letter of Mr. HALLY to Sir JONAS MOORE, written from Dantzick, giving an account of his safe arrival there; of his delivering his letters to Mr. HVELIUS, and of the very kind acceptance of them and entertainment of him; of Mr. HVELIUS's great esteem and respect for the Royal Society: that he, Mr. HALLY, had seen Mr. HVELIUS's observations and instruments, and found them very extraordinary, but all with common faults: that he had seen Mr. HVELIUS make observations with those instruments of the distance of two fixed stars, and that they were capable of making them to half a minute; but that he was not able to do this nearer than to a minute: that his contrivance for setting his instruments to the plane of the stars was very good: that he had published the second part of his *Machina Cœlestis*, containing his observations of the fixed stars; and that he had sent some copies of that work to England.

Two letters of the secretary were read, the one to the Abbé de la ROCHE, the other to Monsr. JUSTEL, in order to begin a correspondence with them concerning philosophical subjects; which letters were approved of by the vice president.

The minutes of May the 29th were read; which gave occasion to discourse farther about the softening of the bones in fish boiled; and Monsr. PAPIN being present, he was asked, whether he used water in that operation; which he denied, affirming, that he put no water to it in the boiling.

Mr. HOOKS propos'd it as a very useful mechanical operation for making of inlaid works with bones or ivory, to stain them with colours while soft, to see if they would hold those colours, when dry and hardened again: and he affirm'd, that he knew a method of dying ivory as black as jet, and sinking the colour in to a considerable depth, so as to be very lasting, without softening the ivory; but that he could not do the same thing with other colours.

Hereupon some discourse was occasioned about China ink, some supposin' it to be made of burnt bones; others of very fine lamp black, though others thought it might be an inspissated juice.

Mr. COLWALL mentioned a way of making very good ink, casting a little upon a purple, which was with deep coloured claret, with galls and copperas, without gum.

Sir JOHN HOSKYNs suggestin', that Monsr. PAPIN's way of softening bones would be of good use for cooking of bony fish, which were troublesome in eating, the latter added, that he had tried that effect, and found, that he could soften fish-bones as well as others.

The

The observations made at the last meeting on grain-gold were discoursed of; and it was observed by Mr. HENSHAW, that the first gold brought from Peru was grain-gold; but that afterwards the industry of the planters found out the mineral, from which it might be drawn by quicksilver.

Sir JOHN HOSKINS said from the report of some other person, that the lead-mines in Wales contained a greater proportion of silver than most other mines in Europe, and as much as most of the Spanish silver mines.

Mr. HOOKE read a farther discourse of PADRE LANA concerning flying, which he had translated; and added to it a discourse of the impossibility of that attempt by that means; and also shewed wherein the author had been greatly mistaken in the grounds and suppositions of his demonstration, viz. in supposing the same thickness of metal to be sufficient to resist the pressure of the air inward in a ball of twenty-four feet diameter as in a ball of one foot diameter; whereas on the contrary it is necessary to increase the weight of the shell more than according to the proportion of the solidity or capacity of the ball.

Dr. GREW read a paper of his concerning most of the mineral waters about London.

Mr. JOHN WHEELER was proposed candidate by Sir JOHN HOSKINS.

June 12. There being but a small number of members present, the Society did not sit, but were entertained with the examination of several experiments.

The first was the body of a mackerel boiled by Monsr. PAPIN after his new way, which being examined by several, it was found, that the flesh was very solid, hard, and whole, and very well tasted, without any unusual quality, except that all the bones of it were as soft almost as the flesh itself.

The second was a parcel of hartthorn, which had been formerly softened, and shewn to the Society, and kept since that time close stoped in a glass. This being smelt, tasted and felt, seemed by all those senses to be old Cheddar or Parmesan cheese.

The third were the chips of oranges softened by the same art, which were very whole, but made throughout very tender. This way of boiling was affirmed by Monsr. PAPIN to be very useful for making sweet-meats.

The fourth was the tendril of a vine brought by Mr. THOMAS CRISPE; which being examined by Mr. HOOKE with a microscope was found to have a good number of small plants seeming a kind of moss growing on it; the stalks whereof were about half an inch long, and as fine as the hair of a man's head; but at the end of each of which grew a pod much like that of seeding moss, but very much smaller.

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R R R

June

June 19. There being but few members present, and Sir ROBERT Viner and Sir ROBERT CLAYTON being there were entertained by those members with a sight of the repository, library, and weather-clock newly set up.

Monf. PAPIN shewed a new kind of wind-fountain of his own contrivance.

June 26. Sir CHRISTOPHER WREN, vice-president, in the chair.

The minutes of the 5th and 12th of June were read: whereupon occasion was given to discourse farther about the China-ink; which some supposed to be an inspissated juice; but Sir CHRISTOPHER WREN affirmed it to be only lamp-black very finely ground, and made up in cakes.

There was also a discourse about the way of softening bones by Monf. PAPIN: concerning which Sir CHRISTOPHER WREN queried, whether the way of softening them did not hint by a contrary process a way of hardening either the same or other bones not softened first. To which Monf. PAPIN gave no positive answer, having not yet discovered to the Society his way of doing that operation.

Mr. HOOKER produced an intire cocoa-nut, which was newly brought from Barbados; and he caused it to be cut in sunder, and poured out of the middle of it a glass full of liquor containing about a third part of a pint. This liquor was something whitish, and tasted sweetish and pleasant like an emulsion. It was contained in the cavity of the kernel, which might be capacious enough to hold about a pint. The kernel was about three fourths of an inch thick, lining the inside of the shell, which was about one eighth of an inch thick and very hard. The kernel was much of the same taste with the liquor, but pretty hard and tough.

Dr. CLENCH being introduced by Dr. TYSON addressed himself to the vice-president, and presented the Society with a certain root lately brought out of China, called ginseng, of great esteem in China for its virtue in restoring consumptive persons, and those emaciated with long sickness, to their former health and strength. It was valued in China at twice its weight in silver. It is shaped like a briony root, but is scarce so big as a finger. It is white like a parsnip. Its taste is very bitter and somewhat hot upon the tongue somewhat like gentian, and seems upon the same account to be a very good stomachic.

Dr. CLENCH delivered in some of it for the repository wrapped up in Chinese paper, together with a paper containing an account of some of his trials and experiments made with it in England.

Dr. GREW read a paper of his observations made on several medicinal waters, viz. from Gilsfapaw, Sunning-hill, and Willow bridge in Staffordshire; on a petrifying water from Oxfordshire; on sea-water from Sandwich; and on another kind of salt water from the Black Sea.

After

After the reading of this paper he shewed some of the salts exhausted, and amongst the rest the salt of the Euxine-Sea water, which being tasted was found to be a perfect caustic, and exceedingly different from any other kind of sea-salt.

Mr. Hooke produced the breast-part of a new sort of armour made of silk well quilted together, which was able to resist the shot of a pistol or carbine. It was near three fourths of an inch thick, and very hard and pretty heavy. Whether it would perform what was pretended concerning it, the Society was not convinced by any experiment: only the gentleman, who owned it, shewed it with two bullets, which had been shot against it by the prince* in the king's presence, which were very much battered and flatted against it without at all penetrating it.

July 3. At a meeting of the COUNCIL were present

Mr. HENSHAW, vice-president,

Sir JOHN LOWTHER,

Mr. HILL,

Sir JOHN HOSKYNs,

Dr. GREW,

Mr. COLWALL,

Dr. MAPLETOFT,

Dr. CROUNE,

Mr. HOOKE.

It was ordered, that Mr. Hooke shall have power to employ Monsr. PAPIN for the writing of all such letters, as shall be ordered, to the correspondents of the Society: and that all such letters shall be transcribed into a Letter-book to be kept by the secretary of the Society: and that all the said letters, when fairly written, shall be shewn to such person of the Society, as the council shall appoint from time to time for viewing of them before they be sent to the correspondents, and after such perusal shall be sent by the secretary as directed: and that for so doing the said Monsr. PAPIN shall receive from the treasurer of the Society the sum of eighteen pence per letter, unless the letter shall exceed two sides of a quarter of a sheet of paper, for every of which he shall receive two shillings, he producing his bill of the number of such letters signed and attested by the Secretary:

That the letters being approved of by any two of the council shall be sealed and sent as above:

That Mr. HILL the treasurer pay Dr. POPE ten pounds for one year's rent for the use of his lodgings as astronomy professor in Gresham-College, due February 23, 1677: And,

That Mr. Hooke be desired to publish (as he hath now declared he is ready to do) a sheet or two every fortnight of such philosophical matters, as he shall meet with from his correspondents; not making use of any thing contained in the Register-books of the Society without the leave of the council and author.

At a meeting of the SOCIETY the same day, Mr. HENSHAW, vice-president; in the chair.

* RUPERT.

R E F 2

One

One of the copies of Mr. HVELIUS's second part of his *Machina Cœlestis*, containing the second, third, and fourth books, newly sent over by the author to several of his friends in England, was shewn to the Society by Sir JONAS MOORE; in which were found Mr. HVELIUS's celestial observations for the space of forty-nine years.

Sir JONAS MOORE mentioned, that Mr. HALLEY designed to visit him in his future, and to take the latitude of that place.

The minutes of June 26th were read; which gave occasion of discoursing farther about the milk or liquor contained in the cocoa nut. Dr. GREW was of opinion, that all that milk would by degrees, as the fruit ripened, thicken into a kernel; and conceived farther, that the young plant lay in that, and not in the substance of the hollow kernel.

Mr. HOOKE was desired to examine PISO's natural history, to see, if any light touching this conjecture might be obtained.

It was farther related, that the palm-tree-wine was not this liquor of the cocoa nut, but the sap of a tree got out of the body of the palm, by boring a hole in the tree, and putting a tap into it, much after the manner that birch juice is procured.

Mons. PAPIN was introduced by Mr. HOOKE to shew the Society some further trials, which he had made of his invention of boiling, upon tortoise-shell and ivory. The first was observed to be very soft and pliable, but with a considerable toughness, much like wetted tanned leather. The second had been boiled in ale or beer, and had thereby the parts of it extremely softened, and remaining it were looke one upon another like rotten wood. He was desired to prosecute some farther trials in that way by boiling some lobsters, oysters, prawns, &c. to see whether they may be this way softened.

Dr. GREW produced and read a paper of some observations made by him on some other waters in and about London.

Mr. HOOKE produced a packet of books, which were sent to him directed for the Society; which being opened were found to be some catalogues of Dr. SWAMMERDAM's rarities; one of which was referred for the library, and the rest distributed to several of the members.

There was some discourse held concerning waters, whether those, that were impregnated with alcalizate salts, would draw tincture more plentifully than fresh water. Dr. GREW was of opinion, that they would; but Mr. HOOKE conceived, that fresh water would draw a much stronger tincture from a plant before it was impregnated with salt than after; for which he alledged many reasons, and insisted particularly in the way of drawing tinctures from scenna, the one with fair water,

water, the other with water impregnated with salt of tartar; the first of which would be the strongest, though the other appeared deeper.

Dr. SLARE was introduced by Mr. HOOKE to shew the Society the experiments of animals in *femine animalium*. He brought with him the liquor, which he had lately expressed out of the testicle of a stone-horse, which had been newly gelt. This liquor he took up in small canes, and viewed them with a single microscope, whereby they were made visible; but Mr. HOOKE putting some of the liquor upon the plate of his double microscope, an infinite number of those small wriggling creatures might very plainly be distinguished, and were discovered and observed by most of the members, who were present.

July 10. Mr. HENSHAW, vice-president, in the chair.

Mr. LAMB's proposals about two celestial hemispheres^e were shewn; but when it was understood, that they were not rectified by the late observations of Mr. HEVELIUS, they were neglected as imperfect.

Mr. JOHN VALENTINE SCHOEN of Strasburgh was present, and desired to receive the commands of the Society, being soon to return home.

The minutes of July 3d were read, and Mr. HOOKE was desired to examine PISO about the cocoa nut. Sir JONAS MOORE said, that the Indians use to bore a hole in the palm-tree, and to roll up a leaf of the tree, and stick it into the hole for a spout for it to run by into a cup made of the shell of its own nut. They use to tap them in the morning before sun-rising.

Mr. HENSHAW observed, that the palm, that yields wine, is only in the East Indies, where they drink no other: and that the way used by the Indians for climbing up the palm-tree was by the help of a couple of short ropes, the one tyed to their feet, the other about their arms, by the successive sliding up of which they will climb to the top of the smoothest and straightest tree.

Sir JOHN MOSKYNs remarked, that there was one palm in Guinea, the fruit whereof yielded a good quantity of oil used in those countries instead of butter, though not so agreeable to the Europeans.

It was farther observed, that the wine of the palm will with keeping turn to very good vinegar, and being boiled presently yields good sugar, and being fermented makes a very good wine.

Mons. PAPIN produced a piece of the tortoise shell, which he had shewn at the last meeting soft like wet tanned leather, now reduced to its former hardness and transparency, and retaining the posture, which it had been put into, when

^e See Mr. HOOKE's *Philosophical Collections*, n^o 1. P. 44.

soft. This, it was supposed, might be very useful for many mechanical works; and if the same effect could be performed upon horn, it was thought, that it might be very acceptable to divers mechanics.

Upon this several discourses arose about tanned leather; and Mr. Hooke urged, that the tanning of leather consisted only in the drawing out of the glutinous part of the skin, and the leaving the fibrous part; which was the reason why skins not well tanned being wet and dried again become stiff and hard, the remaining guminous parts glewing the fibres together; whereas tanned leather being wet and dried again becomes limber and supple as cloth, it having no guminous parts left. Whereupon divers discourses were occasioned about the several ways of tanning leather.

Sir JOHN HOSKYNs mentioned the way, that the Indians in Virginia and the northern parts of America use to dress their skins; which is by the means of the brain of the creature, which they kill, mixed with oil of walnuts called hickery nuts, and a wine made of oyster-shells. With this they smear over the raw side of the skin, and by help of the fire presently dress it with the hair on, that it equals, if not exceeds any way used in Europe.

Mr. HENSHAW conceived, that the Russian and Turkey way of tanning their leather was with the bark of the birch and the saw-dust of fir. He also said, that they had a sort of wooden cups in Russia, which were as tough as leather, and might be turned inside outward without breaking; and that they have a sort of apples as transparent as a ripe white grape; so that the core and kernels may be plainly perceived from without.

Monsr. PAPIN produced a lobster, which he had boiled after his new way, but the shell thereof was not much softened; but the body thereof yielded a considerable quantity of liquor.

Mr. HOOKE read a translation, which he had made of a letter of Mr. L. WENHOEK formerly read by Dr. GREW, in which the writer gave an account of his observations made on the seed of animals, as of fishes, birds, and beasts; in all which, he affirms, that he had discovered with his microscopes vast quantities of living creatures exceedingly small: to which he annexed a paper, in which he had calculated both the number of these animals in the milt of a cod fish, and the number of men at one time upon the habitable face of the earth, and concludes, that the number of the former exceeds the latter at least ten times.

Dr. GREW shewed some draughts of the guts of some creatures, which he had formerly dissected; of which he promised to bring in an account, but he could not leave the draughts.

July 17. Sir JONAS MOORE, vice-president, in the chair.

Sir THEODORE DE VAUX presented two books sent by the grand duke to the president

president and secretary of the Society by the hands of Signor TERRE, that prince's resident in England, being two copies of STEPHANO LORENZINI's *Osservazioni interne alle torpedini*, printed at Florence in 1678.

These were recommended to Sir JOHN HOSKYNs and Mr. HOOKE to be perused by them, who were desired to give some account of the contents of that book at the next meeting.

Mr. POVEY inquired of Mr. FLAMSTEAD concerning the heat of Greenwich-Hill, who said, that it was temperate. Whence was occasioned some discourse concerning the heating of the air by the beams of the sun either direct or reflected; and it was argued, that the heat of the earth was one of the greatest causes of warming the air near the surface; whereas the air at the top of hills being much in motion, and farther removed from the surface of the earth, was not so much heated.

Mr. HOOKE gave an account of his having perused PISO about the cocoa nut, and related, that this author affirms the young cocoa nut to be full of a pleasant milky juice, but that when it is fully ripe, that juice is dried away, and there is only a hollow kernel left within the hard cocoa shell. Upon this occasion mention being made of the Indians climbing those palm-trees, Mr. HOOKE described the way of their doing it by the use of two short ropes, the one fastened to their feet, the other to their arms, by the help of which they could climb to the top of the straightest, smoothest, and highest trees.

Upon mentioning the Russia apple, that was transparent, Mr. HILL mentioned, that there is in England such an apple called the cucumber-apple, which is somewhat transparent in several of its parts and cells.

Mr. POVEY, upon the discourse of the cocoa wine, affirmed, that there was no sweet juice but what would turn to the sourest vinegar; and that the palm-tree wine would accordingly do so.

Upon reading the relation of the way of tanning of Russia leather Mr. POVEY proposed, that Mr. CHARLES HOWARD's experiment of tanning might be tried by the Society; and that he was willing to communicate to them; and he undertook to procure the way, and to bring it in.

Mr. HILL affirmed, that all the Russia leather brought into England was made of elk-hides. Thereupon a farther discourse was occasioned concerning the curious colour and lasting smell of Russia and Turkey leather, and a farther inquiry concerning the materials, with which it was tanned: and Mr. POVEY mentioned, that the cuttings of Russia leather being laid in a chest amongst clothes was an infallible way of preserving all within it from moths.

Sir THEODORE DE VAUX observed, that the lying on those skins was very good for

for such, as were troubled with the stone. Others affirmed, that the lying on oiler-leather would have much the same effect.

Sir JONAS MOORE related, that Mr. FLAMSTEAD had formerly given him a description of the way and process of making Derby malt, and promised to look it out, and bring it to the Society. He also added, that the people of that town had a way of cooling their ale very quickly, so as it blinketh it so, as they called it, that it grows clear and fit to drink presently.

Several ways were mentioned of the clarifying of ale; the worst of the alewives by putting a chamber-pot into it; another of a pewter-dish, and another with a green oaken bough.

Mr. POVEY said, that there was a way of making a very strong and very pale ale with wheaten malt. Others remarked, that the same thing might be done with common malt by putting whole wheat into the ale.

Dr. GALE said, that there was a way of making mulberry-ale or groot-ale presently work, clarify, and be fit for drinking, by putting into it a kind of leven made of the yeast of empty casks dried and made up into a ball: but that was not approved to be so pleasant or so wholesome.

Mr. POVEY promised to bring in a receipt of making very pleasant, wholesome and strong ale, and as good as any.

Thereupon Sir THEODORE DE VAUX promised to bring in a dozen receipts, which had been experimented by Sir THEODORE MAYERNE for making of ales of several sorts.

This occasioned a discourse about various ways of making wines and other pleasant and wholesome drinks of other sorts.

Sir THEODORE DE VAUX promised to bring in the receipts of making divers of them, as with currants, water and sugar, and with raisins and water: and Mr. POVEY related, that the earl of Northumberland had made much use of this last wine; and that a distiller of Vaux-hall made spirits with such wine. Others affirmed, that it was used also by several other distillers.

Hereupon much discourse arose about making wine with cherries only, of which there is so great plenty in Kent and several other parts of England: and it was wished, that that design might be promoted, since it would greatly save the expence of foreign wines, and much improve our own country.

Mr. EVELYN affirmed, that he had made wine with cherries, which kept very well two years; as also, that he had made an excellent drink of quinces.

Sir THEODORE DE VAUX mentioned a way of renewing and refreshing palled and

and decayed wines by putting raisins in it. And Mr. Hooke said, that he had known a merchant, who made use of the juice of English grapes to renew his wines.

Mr. POVEY promised to give an account of the gooseberry wine, which he had lately made.

Mr. EVELYN promised to communicate some of his ways of making cherry and some other English wines.

Dr. GREW was called upon to bring in his paper about the guts, which he had shewn at the former meeting.

Sir THEODORE DE VAUX related, that there was lately found at Acton a water, which was twice or thrice as strong as Epsom water, being very bitter.

Dr. KING said, that upon evaporating it, he had found above double the quantity of salt in it, than he had found in Epsom water.

He added, that it was an ill custom to put common salt into such waters to make them purge.

Dr. GALE observed, that it was an ancient way used by physicians in Egypt and Greece.

Mr. Hooke shewed two experiments: the first was the testicle of a lamb, which being dissolved, and the liquor contained in it examined in a microscope, it was found not to have any live animals, but to be exceedingly full of the small globules. Whether there had been any creatures in it, and were now dead, by reason that the lamb had been killed in the morning; or whether there were not as yet any living creatures in it, the lamb being not come to maturity for generation, could not be distinguished. But farther trial in order to this inquiry was desired to be made on a young lamb's stone, as soon as the creature should be killed.

The second experiment of Mr. Hooke was with the exhausting engine of Mons. PAPIN: and that was with a long helical spring of brass-wire extended by a weight hung at the lower end of it, the upper end of the same being fastened to the top of a long glass cone. Out of this cone the air was well exhausted, and the station and length of the spring was curiously observed: then the air was let in, and the same observations were made with the same cone; and it was found, that the whole pressure of the air did not in the least alter the stiffness of the spring; which cleared that dispute, whether the unequal motion of a watch does not proceed from the alteration made on the spring by the various pressure of the air thereupon.

Mons. PAPIN shewed his way of exhausting small glasses for preserving •• and
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keeping them tight by the help of a looking-glass-plate ground true upon the edge of the glass.

July 24. Sir JONAS MOORE, vice president, in the chair.

The minutes of July 17th were read; whereupon Sir JOHN HOSKYNs was desired to give the Society an account of the Italian book of LORENZINI on the torpedo; which he had undertaken to peruse; and accordingly he gave the following account of it:

That the book was full of curious and new observations: that the author had very minutely and particularly described the torpedo and its parts: that it is of the sort of the flat cartilaginous fishes: that there are two sorts of it, a greater and a lesser: that he had seen of the greater weighing twenty-five pounds, and of the less not above six ounces: that in the skin are several pores, which are the ends of double ducts to bring slime to the skin to make it slippery: that one of these ducts comes from the head, the other from the sides of the back: that the brain touches the pia mater in the base only, being separated elsewhere by water, in which it swims: that the heart has but one ventricle, and continues to move nine or ten hours after it is cut out, as the parts of the body, when separated, will in four or five hours: that its ovary is near the liver and double oviduct and womb, wherein the young ones swim free, and have no communication with the womb; the author by the describing the genitals of a lobster and some other fishes, and shewing some errors of Dr. WILLIS: that the benumbing quality is seated in two semicircular muscles on each side of the thorax, consisting of fibres about the bigness of a goose-quill made up of bladders filled with a liquor, and they end in the back and belly: when the hand touches these, the fish contracts them, and squeezes out the liquor, which enters the skin at the fingers-ends, and causes the numbness like that of the elbow hit against a hard body; but the numbness and pain vanish in a short time: that nothing but immediate contact will produce this effect: that this fish, as most others, has properly no tongue: that the stomach and guts are short and large with few fibres, but abound with a copious dissolvent, that consumes the fish which it swallows alive, into a chyle: that the fish takes in water by several holes near the stomach, and throws it out at the other end, washing in its way the bronchia: that the author often recommends experimental philosophy and comparative anatomy.

Dr. CROWE queried, whether the author had said, that this benumbing liquor is any colder than the rest of the body: to which Sir JOHN HOSKYNs answered in the negative.

Mr. HILL related, that Mr. TORRIANO lately drinking the waters at Epsom found, that they passed well the three first days, but did not the fourth and fifth. Whereupon he soon after died, and being opened, his guts were found gangrened.

Monf.

Monf. PAPIN promised to communicate at the next meeting a method of keeping large vessels exhausted with ease, in order to boiling and distillation.

Mr. HAAK produced a book intitled *Propositions of Optic Glasses*, printed at the theatre at Oxford.

Mr. HOOKE, who had read somewhat of the book said, that he had not found any thing in it, which was new; and that it contained some propositions about the place of the image, which were not true: that it came far short of the theory of optics now well known, which he conceived to have been first well understood by KEPLER, and highly improved by DES CARTES.

Mr. HOOKE read a long paper, which he had translated from the French, giving an account of the prodigious overflowing of a river in Gascoigne, written by a person, who had made it his business to inquire into the truth of the fact, and had likewise been inquisitive after the cause, which he explained and illustrated by divers very convincing circumstances, ascribing it to the * * * * of some of the Pyrenean mountains into the subterraneous cisterns within the bowels of them.

This occasioned a discourse of the effects of the like nature; and Sir JONAS MOORE and Mr. HOOKE mentioned some, that had happened at Pendel-Hill, of which an account had been given in a letter read to the Society.

Dr. GALE added, that there were many instances of the like nature in the mountains of the north, where gushings out of the water from the hills made great gills, as they were called; that is, channels in the sides of them, out of which the water gushes from the mountain.

Dr. CROUNE read a letter from Mr. HEVELIUS in answer to that, which he had written to him, and sent by Mr. HALLEY; wherein Mr. HEVELIUS testified his respect for the Society, and his esteem of Mr. HALLEY.

Sir JONAS MOORE read a letter from Mr. HALLEY, giving a farther account of his reception and entertainment in astronomical matters by Mr. HEVELIUS.

Mr. HOOKE was desired to get the Italian book* translated into English, and printed; which he promised to endeavour to do.

Upon the discoursing of optics Sir JONAS MOORE having said, that he had a piece of Mr. GOSSIGNES in a Latin manuscript on optics, as also divers papers of Mr. GASCOIGNE's on the same subject, he was much desired to procure them to be printed; Mr. HOOKE, who had some years since seen that tract of in Mr. COLLINS's hands, judging it to be very good and fit for publication.

July 31. Mr. HENSHAW, vice president, in the chair.

* This account is printed in Mr. HOOKE's *Philosophical Collections*, n^o 1. p. 9.

* Probably that of LORENZINI on the torpido.

The minutes of the 24th instant were read, which gave occasion for some additional observations, viz.

Sir JOHN HOSKYNs observed, that Signor MALPIGHI had observed, that the reason of the mobility of the parts of insects, after they are cut asunder, is from the brain and medulla spinalis.

Mr. HENSHAW conceived, that it might be partly from that, and partly from the sliminess and toughness of the juice, in which the spirits moved in these creatures, which were observed to move after they were cut to pieces, this juice keeping the spirits, without suffering them presently to evaporate.

Sir JOHN HOSKYNs conceived, that devouring animals knowing where to fatten on their prey so as to kill them immediately (as had been observed of a lion griping a lamb and a dog to death at one bite) fishes likewise may have that instinct to bite the torpedo to the heart: whence nature seems to have furnished that part with the preventive, viz. the benumbing quality, whereby, as it is supposed, the preying fish becomes immediately benumbed, and the torpedo escapes.

Mr. HILL mentioned a person, who passing over a field in a very cold day found himself as it were stricken on one side of the belly by a cold blast with much pain; which pain continuing for two days killed him. Upon opening his belly it was found gangrened in that place. This kind of cold is called by the country-people the cold fire, and is very usual in Russia and other cold countries.

Sir JOHN HOSKYNs added, that CARPENTER^e in his *Geography* had made mention of just such an eruption of water out of the hills, as that in Gaiscoigne mentioned at the last meeting; as also of subterraneous fish.

Mr. POVEY presented to the Society for their repository from Mr. JOHN SHORT the draper the head of a turtle very large, the mouth of a shark, the heart of a tortoise, the nether part of an Indian crow's bill, the *piscis quadrangularis*, the tusk of a boar, a part of an Indian lo^o in shape like that of the acacia.

Mr. HOOKS read a discourse of his concerning the use, which he had found of convex glasses for helping short-sighted people to see objects at any distance very distinct and bigger than any one, which the naked eye can distinguish; which is a discovery of much benefit to short-sighted persons^f. He called his discovery *myopibus juvamen*, and observed, that by the use of seeing things inverted it became as natural as if they were seen erect; and he conceived, that if a person from his childhood were used to see things by this means inverted as we call them, though they were really erect in the eye, if they should afterwards come to see them without the help of these glasses, they would conceive, that they saw

^e NATANIEL CARPENTER, D. D. fellow of Exeter-College in Oxford, and afterwards school-master of the king's wards in Dublin. He died

there in 1628.

^f This discourse is published in Mr. HOOKS's *Philosophical Collections*, n^o 3. p. 59.

them inverted, as they really are, at the bottom of the eye, as he said was very visible in a young cat's eye, which is almost transparent at the bottom.

Mr. COLWALL gave an account from Mr. FLAMSTEAD, that he had prosecuted the observation begun and invented by Mr. HOOKE of observing the parallax of the earth's orb among the first stars by a perpendicular telescope; and that he had certainly found what it is. It was hereupon moved, that Mr. HOOKE should desire the observation of Sir JONAS MOORE, and insert it in the next *Transaktion*.

Monk PAPIN produced an instrument, by which he could boil any thing *in vacuo*; and shewed the manner of exhausting with his engine, and how he preserved it from leaking, whilst it boiled, by tin and screws, &c.

Mr. HOOKE produced and examined the testicles of a cock just killed, but could not perceive any of those small animals in its seed, that had been seen in that of a stone-horse. It was conceived, that the reason was, because the cock was very young, and possibly not fit for generation.

August 7. At a meeting of the COUNCIL were present,

Mr. HENSHAW, vice-president,

Sir JOHN HOSKYNs,
Mr. COLWALL,
Dr. GALE,
Mr. HILL,

Dr. BROWN,
Dr. GREW,
Mr. HOOKE.

It was ordered and desired, that Mr. HOOKE do, as soon as may be, print a relation of all the experiments, observations, and relations made and brought in to the Society by himself since his first coming into it; and that he have leave to take his own method in the doing thereof.

It was left to him to print the *Transaktions*, which he designed to publish, either once a month or once in a fortnight, or oftener.

It was ordered, that Mr. HOOKE shall proceed with the correspondence, and send away such letters, as are already written; and likewise take care to defray the charge of postage both outwards and inwards:

That Sir JOHN HOSKYNs, Sir JONAS MOORE, Mr. COLWALL, Mr. HILL, Dr. GALE, Dr. BROWN, Dr. GREW, Dr. MAPLETOFT, or any three of the council, do meet together, and go to Mr. CHENEY to discourse with him concerning Chelsea College; and that in the mean time Sir JOHN HOSKYNs be desired to inform himself as fully as may be concerning the title of the Society to Chelsea College; and in order thereunto get copies of such records, as he conceives necessary and are wanting; and that they meet at Mr. COLWALL's house on Tower-hill on the Wednesday following at three in the afternoon precisely:

That

That all papers, that for the future shall be brought into the Society to be read, be returned to the person, who brings them, if he desires the same: And,

That the following bills be paid,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
A bill of Dr. GREW for seven lectures	-	-	9 0 6
A bill of Mr. MARTYN for lifts, tickets, &c.	-	-	5 4 0
A bill of Mr. WICKS for expences ending at Christmas 1678	-	-	5 5 0
A bill of Mr. WICKS ending May 29, 1679, for writing, &c.	-	-	16 0 0
Mr. WICKS's salary for 1 $\frac{1}{2}$ year ending midsummer 1679	-	-	15 0 0
The Stationer's bill to July 4, 1679,	-	-	6 16 0

At a meeting of the SOCIETY on the same day, Mr. HENSHAW, vice-president, in the chair.

The minutes of the 31st of July were read. whereupon there was a farther discourse about short-sighted persons, and of the ways of vision, from the assertion of Mr. HOOKE, that a man used to see things always inverted would in time judge, that he saw them as they are. Dr. CROUNE queried, whence it should come, that the conception should imagine that object erect, which is represented at the bottom of the eye inverted. Dr. GREW supposed, that it might proceed from the inversion of the optic nerves, which might cause a second inversion. Mr. HOOKE thought, that this could not be the cause, since it was not general in all creatures, and he conceived, that the inversion of the optic nerve was in none observable: but that it rather proceeded from the mind's making comparison of the sensation by the eye with the sensation made by the touch: or rather, that it is an idea or the rule of sight implanted in the soul by nature.

Mr. HENSHAW mentioned the explanation given of it by DES CARTES, who compares the sight to the feeling of an object by the medium of a staff.

Mr. HILL mentioned, that a maid, who was blind from her infancy, and never saw any thing till Mr. STEPKINS cured her, upon the first recovering of her sight, looked on the sun, and thought, that she could have reached it: whence it was inferred, that the mind judged of distances partly by circumstances.

Mr. HENSHAW observed, that the sun in Norway very often rose and set in an oval figure. Mr. HOOKE affirmed, that it was likewise so here for the most part; which was caused by the refraction or rather inflection of the air, as he had elsewhere shewn.

Sir JOHN HOSKINS remarked, that looking at the sun or stars through a small hole made in paper caused them to appear less than to the naked eye.

Dr. CROUNE gave the reason of the sun's appearing bigger near the horizon from the dilating of the pupil; for that according as the pupil is dilated, the object appears bigger or less.

Mr.

Mr. Hooke affirmed, that if you look through a hole an hundred times less than the pupil, the object will appear the same that it does to the naked eye, when it sees it distinctly : but in objects too strong for the eye, it helps the eye by debilitating the rays, which otherwise make a false representation.

Mr. HENSHAW was of opinion, that the refraction of the air might cause the sun to appear bigger ; and that the vapours also might augment it. Dr. CROOKS was also of the same opinion, that the vapours might augment it rather than the refraction, because the air consists of parts very different from the æther. In favour of Mr. HENSHAW's conjecture, Sir JOHN HOSKYNs affirmed, that at noon-day the sun would appear much bigger, when seen through a very thick fog, which fog he conjectured was nothing else but an infinite number of exceedingly small drops.

Mr. Hooke conceived, that the object, as the sun, moon, &c. in all probability appeared under the same angle to the eye ; but that the judgment or fancy imagined it to appear bigger or less according to the distance, at which it conceived it to appear : and therefore those luminaries are usually conceived bigger, because they are seen to be farther off than the objects nearer of known magnitude : that the refraction is so far from augmenting them, that it rather diminishes them ; for should the whole horizon be raised to the Zenith, it must appear a point, and always the less, the more it is elevated upward, by reason of the contract of the Azimuth : that the imaginary bigness of a sun through a fog arises from the opacity of the air, which is always • • • with objects seen at a great distance, or through a great body of air ; and by this landscape painters deceive the eye, and make it imagine, that it sees things at a distance, because they are painted with faintish blueness : for a man seen in a fog appears of a gigantic bulk ; because, though he be very near, yet being seen through a thick air, the fancy imagines him at a much greater distance.

Monf. PAPIN shewed his experiment of the quantity of the air compressed in his wind-gun ; but the vessel being somewhat too little, it could not be certainly measured, but was found to hold about fifty times the quantity of air, which it held before condensation.

The Society adjourned for the ensuing vacation, not to meet again till summons given ; but such members as pleased to meet to discourse in the mean time, might do so at the repository or library on Thursdays in the afternoon, where there would be some entertainment for them. Accordingly on the 14th of August, 1679, some of them met, when the body of a child, which had been twenty-six years in its mother's belly, and was supposed to have been alive for the space of twenty of them, was exhibited, together with attestations of the truth of the relation, which was published in one of the monthly *Transactions*.

The members present, upon viewing the same, and taking notice of the remarkable particulars, judged it to be a very rare and wonderful production. Mr.

Monf. PAPIN made a farther trial with his wind-gun, and the glafs recipient being now big enough, it was found, that the receptacle thereof, when charged with air fo much as he was able to throw into it by his own strength, contained sixty-four times as much air as it did before it was charged.

September 22. At a meeting of the COUNCIL were present

Sir JOHN HOSKYNs,	Dr. GREW,
Mr. COLWALL,	Dr. BROWN,
Dr. GALE,	Mr. HOOKE.
Dr. ALLEN,	

Upon debate about printing the next *Transaction* it was thought fit, that if Mr. MARTYN should refuse to print the same as usually, the council should be acquainted with it at the next meeting, to consider of some other means of doing it.

Mr. HOOKE mentioning, that Monf. PAPIN was suddenly going for Paris, and therefore desired, that in consideration of the time, which he had spent in entertaining the Society at their meetings, and in writing letters, he might be considered; it was ordered, that the treasurer should present him with five guineas; and that if Mr. HILL the treasurer should not return before Monf. PAPIN's departure, Mr. HOOKE should pay that money to Monf. PAPIN, and receive it from the treasurer.

It was farther ordered, that Mr. HOOKE should propose to Monf. PAPIN in the name of the Society twenty pounds a year certain; and that if there could be found a convenient lodging for him in Gresham-College, he should be allowed it gratis; and that the Society would farther study to assist him;

That Sir CHRISTOPHER WREN, Sir JOHN HOSKYNs, Mr. COLWALL, Mr. HILL, and Mr. HOOKE do, as soon as possible, go to Mr. CHENEY, and view and take possession of such lands, as belong to the Society now lying about Chelsea; and that they give notice to the several tenants of the said lands of such their doings:

That Mr. HUNT take care to have all the instruments of the Society now in the custody of Mr. FLAMSTEAD at Greenwich immediately removed to Gresham-College; and that Sir CHRISTOPHER WREN and Mr. HOOKE be desired to go thither, and take what care they can in it; and that in the mean time Mr. HOOKE write to Mr. MOORE about the same, and desire to have them carefully sent home; and that the committee meet about this affair on the Friday following:

That Dr. GALE have the use of the manuscript of the life of THOMAS BUCKET for three weeks, he giving a note for the secure return thereof according to the orders of council made for that purpose; And, . . .

That

That the treasurer do pay to Mr. Hooke five pounds for the salary of Mr. CRAWLEY for the last quarter ending the 18th of this month; and that the said Mr. CRAWLEY be continued in the employment of the Society till the next meeting, when it was to be farther discoursed of.

September 29. At a meeting of the COUNCIL at Sir CHRISTOPHER WREN's were present

Sir CHRISTOPHER WREN, vice-president,	
Sir JOHN HOSKYNs,	Mr. COLWALL,
Mr. HAAK,	Mr. HILL,
Dr. GREW,	Mr. HOOKE.

It was ordered, that Sir CHRISTOPHER WREN be desired to make the following proposals to Mons. FOUBERT concerning Chelsea-College, and to give an account thereof to the next meeting of the council, viz.

That the accommodations desired shall be provided by Lady-day following :

That the lease shall be made for twenty-one years, the first rent to be paid at Michaelmas, 1680, for half a year :

That the College and six acres belonging to it shall be valued at forty pounds *per annum* :

That the tenant shall pay ten pounds per cent. for the charge of sitting it over and above the said forty pounds *per annum* : and either pay in five hundred pounds (for which fifty pounds *per annum* shall be allowed him) or give good security for the rent.

September 30. At a meeting of the COUNCIL at Gresham-College were present

Sir CHRISTOPHER WREN, vice-president,	
Sir JOHN HOSKYNs,	Mr. HILL,
Mr. COLWALL,	Mr. HOOKE.

It was ordered, that Mr. PERRY^a forthwith speak with Mr. EVERARD, executor of GEORGE ENT, Esq; lately deceased, concerning the books left by the said Mr. ENT to the Society, and take care to have the said books removed to Gresham-College with all convenient speed : and that Mr. PERRY's receipt shall be a sufficient discharge.

Mr. Hooke reporting, that upon his making the proposal of the council of the 22d instant to Mons. PAPIN of twenty pounds a year certain for writing all letters for the Society, he had accepted the same, it was well approved of : but it

^a Library-keeper to the Royal Society.

was farther thought fit, that articles should be drawn up to express the conditions expected by the Society to be performed by him, and to be subscribed by him.

October 10. At a meeting of the COUNCIL were present

SIR CHRISTOPHER WREN, vice-president,	
SIR JOHN HOSKYNs,	MR. HILL,
DR. GALE,	MR. HAAR,
MR. HENSHAW,	MR. HOOKE.

Upon debating the proposals made by Mr. FAUBERT concerning Chelsea-College, it was thought fit and ordered, that the house and the five acres, whereon Chelsea-College stands, shall be let by lease for forty-one years to such persons, as shall be ready and engage to deposit the sum of money required, at the annual rent of thirty pounds: and that Mr. FAUBERT be made acquainted therewith.

Mr. FAUBERT being in the next room was called in, and acquainted with these proposals, who readily concurred with them: and it was desired, that care should be forthwith taken to make this conveyance from the Society; and that Sir JOHN HOSKYNs would be pleased to consult with * * council to that purpose.

It was farther ordered, that a letter should be sent to the president to acquaint him with this proceeding, and to desire his concurrence and assistance.

It was farther desired, that * * * endeavour to find among their acquaintance some persons, who may advance the sum of money requisite to complete the work according as it should be desired.

November 11. At a meeting of the COUNCIL were present

SIR CHRISTOPHER WREN, vice-president,	
MR. HILL,	MR. EVELYN,
MR. COLWALL,	MR. CREED,
DR. ALLEN,	MR. HOOKE.
MR. HENSHAW,	

Mr. HOOKE was desired to find a fit collector for the arrears due to the Society: And,

To get a paper fairly drawn of Mr. FAUBERT's design.

Mr. EVELYN was desired to draw up a letter to be sent to such persons as were much in arrears to the Society.

November 20. At a meeting of the COUNCIL were present

Sir

Sir CHRISTOPHER WREN, vice-president,
 Sir JOHN HOSKYNES, Mr. HENSHAW,
 Mr. HILL, Dr. ALLEN,
 Mr. COLWALL, Mr. HOOKE.

Sir CHRISTOPHER WREN read a letter drawn by himself to be sent to such person in arrears to the Society as shall be agreed upon by the council.

Mr. HOOKE was desired to inquire after Mr. ROBERT REYNOLDS.

Sir CHRISTOPHER WREN, Mr. HENSHAW, Sir JOHN HOSKYNES, Dr. CROUNE, and Mr. HOOKE were nominated a committee to audit the treasurer's accounts.

It was ordered, that the treasurer pay to Mr. HOOKE the last quarter's salary ending at Michaelmas past.

At a meeting of the SOCIETY on the same day, Mr. HENSHAW, vice-president, in the chair.

The minutes of the last meeting of August 7th were read; which gave occasion of farther discourse about sensation and sight, and was concluded, that sensation was performed by the help of the medium; and that the eye judged of the place of the object only by the impression made on the eye by the end of the rays, which immediately touched the eye; and that the imagination always conceived those rays to proceed in a direct line to the objects, and was not sensible of any refraction or reflection of those rays without some other help to inform the judgment: that direct * * was much of the same nature with the feeling of different substances by the help of a stick, which is strait; and so the blind man distinguishes the nature and position of those things, which he touches with his stick by means of his hand; which directs and holds the stick fast, so that any thing, that moves the end of the stick, moves also his hand: That the refracted or reflected ray is imitated by a stick variously bent, whereby the blind man not knowing of it supposes the substances touched by the end of it to be there, where that part of the end of his stick held in his hand directly points.

Mr. FLAMSTEAD related, that he had observed the refraction to be a whole minute at the height of forty-five degrees; and that it was very considerable also at the height of sixty degrees.

Dr. CROUNE took notice, that it was a desirable thing to have the barometer observed in several places, since it sometimes varied very much in a small distance of places: to confirm which he alledged, that by comparing the observations made at Paris with those, which he had made in London, he had found them sometimes to differ very much.

Mr. FLAMSTEAD conceived, that the barometer was only altered by the wind.

Mr.

Mr. HENSHAW was of opinion, that this alteration proceeded from the vapours in the air; and that the greatest part of those vapours were brought from between the tropics into these northern parts.

It was desired, that Mr. HOOKE should write to professor STURMIUS at Altorf to request him to keep an account there of the variations of the barometer; which Mr. HOOKE promised to do.

Mr. FLAMSTEAD affirmed, that he had compared the observations of Mr. TOWNLEY with his own, and found them much the same, and to differ very little.

It was observed, that the last rains were general throughout all Europe; and therefore it was conceived, that the alterations of the barometer extended likewise very far, and were almost universal.

Dr. CROUNE took notice, that the great thunder in * * extended also very far, though thunder often extends but a little way.

Mr. HOOKE gave an account of the trial, that had been made with Monf. PAPIN's wind-gun for condensing the air to a sixty-fourth part of the space, which it filled before compression. It was desired by the Society, that this experiment might be repeated at the next meeting.

HENRY PAMAN, M. D.¹ was proposed candidate by Dr. CROUNE.

November 27. At a meeting of the COUNCIL were present

Sir JOHN HOSKYNs,	Dr. GREW,
Mr. HENSHAW,	Mr. CREED,
Dr. GALE,	Mr. HILL,
Dr. BROWNE,	Mr. HOOKE.

It was ordered, that Sir CHRISTOPHER WREN be desired to perfect the letter, which he had drawn up to be sent to the members much in arrear; and that the copies of the said letter be made to be sent: And,

That Mr. PERRY be desired to print his catalogue of the Norfolk library with an epistle to the Society making mention of the bounty of the duke of Norfolk².

At a meeting of the SOCIETY on the same day, Sir CHRISTOPHER WREN, vice-president, in the chair.

¹ He had been chosen professor of physic in Gresham college, 21 June, 1677, upon the resignation of Dr. MAPLETOTT.

² This catalogue was printed in 1581, in 4to. at London.

The minutes of November 20th were read: whereupon it was farther debated, whence the alteration of the gravity of the air proceeds, whether from the greater hight of the air by a new influx of air from some other part of the world, where by the perpendicular altitude was increased or diminished, and consequently the presture; or from the new accession of steams, fumes, or saline substances, dissolved and taken up by the air, in the manner of aquafortis taking up into itself silver, copper, iron, &c. and so is made heavier in specie than it was before it was so impregnated: and thus, though it were not increased in bulk or hight, yet it might be increased in gravitation or presture.

Mr. HOOKE was of opinion, that both these causes may concur to produce this effect; and that in order to the examination thereof he had contrived two kinds of barometers, which were first mentioned to the Society, as he conceived, about the year 1662, and lately also, viz. the last year. The first of which should only shew the variations of the presture of the air caused by the alteration of the presture of the air from either or both causes: but the second should only shew the alteration of the presture of the air from the alteration of the specific gravity.

Sir CHRISTOPHER WREN was of opinion, that it proceeded most of all from the impregnating of the air by nitrous salts, which were continually raised up into it.

Dr. CROUNE mentioned, that Dr. GREW had formerly communicated an account of the solutions of salts by water, which would serve to explain this notion; which he conceived it would be proper to consult.

Mr. HOOKE alleged, that he had about eight years before shewn the Society at Arundel-house an experiment to prove the penetration of liquors one into another by putting oil of vitriol into water in a bolt-head of glass; whereby it manifestly appeared, that those two liquors put together took up much less room than when they were separated.

Dr. CROUNE was of opinion, that the air or water impregnated with salts become only heavier upon the account, that they were kept floating together, and a compound of water with an heavier body, as salt, the compound taking up as much room as the same bodies did apart: and there was no certain observation yet to the contrary of that in those bodies; the compound body not weighing heavier than either of the compounding bodies.

Mr. HOOKE alleged, that there were some instances, whereby it appeared, that bodies really penetrated into the texture of each other, and both together took up less room than they did before they were mixed, and so made a body, that was not only as heavy as it ought to be, supposing these bodies mixed together, but a body heavier than either of them; and consequently there must be a penetration of the texture or dimensions of each other. He alleged also, that there is the like penetration in oil of vitriol and water; and also in divers other bodies, which he could

could make evident. It was desired, that an experiment of this kind should be shewn at the next meeting.

MONSIEUR PAPIN produced his wind-gun charged with air, which he designed by a pipe fastened into it to discharge into a large glass filled with water, and inverted into a bucket of water. But upon making the experiment, the pipe being too much pressed by the mouth of the glass, was cracked, and consequently much of the air went not into the said glass; and therefore the certainty of the experiment could not be now examined; but it was desired, that it might be shewn at the next meeting. But MONSIEUR PAPIN having charged it again, shot a plug through an inch board at * * yards distance.

December 1. The Society met upon summons, in order to make their anniversary election of the council and officers for the year ensuing.

SIR CHRISTOPHER WREN, vice-president, took the chair, the president being absent on account of indisposition.

A sufficient number of members being present, the candidates, who had been formerly proposed, were put to the scrutiny by ballot, and these following were elected;

MR. EDWARD TYSON,
HENRY PAMAN, M. D.
WILLIAM NAPPER, Esq;

SIGNOR GIOVANNI AMBROSIO SAROTTI, son of the Venetian resident, who was proposed candidate by Mr. BOYLE.

Then the Society proceeded to their election, according to their usual manner, and the suffrages being collected, it was found, that the following members were continued of the council,

SIR JOSEPH WILLIAMSON,
DR. ALLEN,
MR. COLWALL,
DR. CROUNE,
DR. GALE,
DR. GREW,

MR. HENSHAW,
MR. HILL,
SIR JOHN HOSKYNES,
MR. HOOKE,
SIR CHRISTOPHER WREN.

The new members chosen into the council were,

GEORGE earl of Berkley,
THOMAS BARRINGTON, Esq;
MR. EVELYN,
DR. HOLDER,
EDMUND KING, M. D.

PHILIP PARKER, Esq;
MR. WILLIAM PERRY;
SIR WILLIAM PETTY,
THOMAS POVEY, Esq;
SIR ROBERT SOUTHWELL.

The

The Society then made their election of officers, viz.

Sir JOSEPH WILLIAMSON, president,
Mr. HILL, treasurer,
Dr. GALE, } Secretaries.
Mr. HOOKE, }

The earl of BERKLEY, Mr. EVELYN, Dr. HOLDER, Dr. KING, Mr. PARKER, and Sir ROBERT SOUTHWELL were sworn of the council before the vice-president, Sir CHRISTOPHER WREN, according to the direction of the charter.

December 4. Before the meeting of the Society five of the council, viz. Mr. HENSHAW, Mr. HILL, Sir JOHN HOSKYNs, Sir JOHN LOWTHER, and Mr. HOOKE viewed the gallery, and appointed Mr. HUNT to set up a partition for the library at the west end next the door, to inclose it for a library.

Mr. HENSHAW, vice president, took the chair.

WILLIAM BRIDGEMAN, Esq; was proposed candidate by Mr. HENSHAW. Signor SAROTTI was admitted fellow.

The experiment proposed at the last meeting by Mr. HOOKE, to shew, that copper and tin being melted together into one mass, would make a composition extremely different from them both, was tryed and examined; and it was found, that equal parts of copper and tin melted together made a metal, which was exceedingly hard and very brittle, though the ingredients are both very soft and very malleable: and whereas copper is of a very brown red colour, this was extremely white, and, which was the principal property that it had newly acquired, the specific gravity of it was found to exceed those of both copper and tin; for whereas copper to water is as $8\frac{1}{2}$ to 1, and tin to water as $6\frac{1}{2}$ to 1, and thence the composition ought to have been to water as $7\frac{1}{2}$ to 1; it was found by weighing a part of this substance first in the air and then in the water, that the weight thereof to water was as $9\frac{1}{16}$, or $8\frac{1}{2}$ to 1; for it weighed in the air 2326 grains, and in the water 2060 grains.

Hereupon the cause of this was explained by Mr. HOOKE, and ascribed to the penetration, which those bodies made into one another; and it was illustrated by the experiment, that had been formerly produced before the Society, of the mixtures of water and oil of sulphur or vitriol.

These experiments were made in order to illustrate some theories about the pressure of the atmosphere, to shew how the air might be impregnated with other bodies; whereby the specific gravity thereof might be augmented and altered, the height thereof remaining the same.

Mr. FLAMSTEAD was of opinion, that the levity of the air proceed only from the motion of the air, and the gravity thereof from its standing still; and that the

the same body moved does not press so much, as when it stands still : upon which several things were debated.

Mr. Hooke alleged several observations made by him, which were contrary to that supposition ; for he had found, that after a long and still rain, during all which the mercury had continued to fall, as soon as the air began to move, or the wind to blow, the mercury began to ascend. It is true, that it often happens, that in great winds the mercury is very low : and so it is likewise when there is no wind at all stirring, as in great rains : and it is no new observation, that in stormy weather the air is light, the barometers being all so marked.

The minutes of November 27, and December 1, were read, and some matters thereof debated.

Mr. HENSHAW alleged, that antimony by calcining would increase in weight ; and mentioned, that Mr. BOYLE had found the same thing. It was therefore supposed, that the gravity of the composition of the tin and copper might be caused by addition to it from the fire.

Mr. Hooke alleged, that the composition did not weigh heavier than the two ingredients joined together ; but rather that it weighed lighter than the ingredients together did before the melting, by reason, that some part of each of them was wasted by the heat ; but that the specific gravity of the composition exceeded the specific gravity of the two joined together as one compound gravity ; and not only so, but likewise the specific gravity of the heaviest of them. Besides which he urged, that he had several times calcined antimony by the help of a burning-glass ; and had always found it to grow considerably lighter by such calcination.

Upon discourse concerning foreign correspondence, it was moved, and the Society desired Mr. EVELYN, that he would endeavour to obtain from the secretaries of state, that the Society might have the favour to send to, and receive their letters from their foreign correspondents in the packet of the said secretaries, as they formerly had in the time of Sir JOSEPH WILLIAMSON's being secretary of state, which Mr. EVELYN engaged to endeavour.

Mr. Hooke produced and read a letter of Mr. NEWTON to himself, dated 28th November, 1679, containing his sentiments of Mons. MALLEMONT's new hypothesis of the heavens ; and also suggesting an experiment, whereby to try, whether the earth moves with a diurnal motion or not, viz. by the falling of a body from a considerable height, which, he alleged, must fall to the eastward of the perpendicular, if the earth moved.

This proposal of Mr. NEWTON was highly approved of by the Society ; and it was desired, that it might be tried as soon as could be with convenience.

Sir CHRISTOPHER WREN supposed, that there might be something of this kind tried by shooting a bullet upwards at a certain angle from the perpendicular round every

every way, thereby to see whether the bullets so shot would all fall in a circle round the place, where the barrell was placed. This barrell he desired might be fixed in a frame upon a plain foot, and that foot placed upon a true plain way, and the mouth of the gun be almost in the same point over the plain, which way soever shot.

Mr. FLAMSTEAN hereupon alledged, that it was an observation of the gunners, that to make a ball fall into the mouth of the piece, it must be shot at eighty-seven degrees; and that he knew the reason thereof; and that it agreed with his theory: and that a ball shot perpendicularly would never fall perpendicularly: and he mentioned the recoiling of a perpendicular jet of waters. But this was conceived to arise from some mistake of the gunners, in not well taking notice of all circumstances; since a body shot perpendicularly would also descend perpendicularly; and a body shot at eighty-seven degrees would fall considerably distant from the place where it was shot.

December 8. At a meeting of the COUNCIL, at the house of the president, were present,

Sir JOSEPH WILLIAMSON, president,	Dr. KING.
Sir CHRISTOPHER WREN,	Dr. CROUNE,
Mr. HENSHAW,	Dr. GALE,
Sir JOHN HOSKYNs,	Mr. HOOKE.
Sir ROBERT SOUTHWELL,	
Dr. HOLDER,	

It was resolved, that there shall be some one subject fixed upon for the Society to proceed upon for the ensuing time, as their main work, till they are satisfied concerning that subject:

That within some reasonable time, as a year, or as soon as they shall be satisfied, that it is brought to perfection, something concerning their progress shall be published:

That in pursuance of this design, some one experiment shall be appointed by the Society at every meeting, to be shewn at the next meeting in prosecution of that subject so made choice of.

That the several members present, when the experiment is appointed, be desired against the next meeting to consult such authors, as have treated of the said experiment or the subject in debate, and to deliver in what they shall meet with concerning it; and also to speak their own opinion of it:

That the first thing done at every meeting shall be the reading over of the notes of what was done at the preceding meeting:

That a particular and distinct account and narrative of the experiments made at the preceding meeting shall be brought in fairly written by the curator at the following meeting, and be there read before the Society, in order to its being entered in the Register, in case the Society think fit so to direct :

That whereas it is found, that several experiments made before the Society these late years have been only in the Journal-book, and not in the Register ; all such experiments shall be forthwith transcribed out of the Journal-book, and being first made perfect and full by the curator, be then fairly entered in the Register :

That whoever is in the chair the last Thursday of the month do call to the secretary and amanuensis, and see, if as well the Journal, as the particular experiments, &c. appointed to be entered in the Register, be entered accordingly, and sending them to be so, that under the paper or Journal he writes *Entered* :

That likewise at the same time he view the Letter-books, and see, that the letters appointed to be entered be entered accordingly :

That the secretaries take care to have a small account of philosophical matters, such as were the *Transactions* by Mr. OLDENBURG, and under the same title, published once a quarter at least : and that it be recommended to them to do it monthly, if it may well be ; but at least that it be done quarterly.

Mr. HOOKE being asked concerning the undertaking this matter, answered, that he would see what he could do in it, but could not as yet undertake it absolutely.

December 10. At a meeting of the COUNCIL, at the president's house, were present

Sir JOSEPH WILLIAMSON, president,	
Mr. HENSHAW,	Dr. GALE,
Sir ROBERT SOUTHWELL,	Dr. CROUNE,
Sir JOHN HOSKYNs,	Mr. HILL,
Mr. EVELYN,	Mr. HOOKE.
Dr. HOLDER,	

It was ordered, that Monf. PAPIN should be discharged, but that he be allowed for the time till he be discharged, and paid accordingly.

Mr. EVELYN reported, that he had spoken to the earl of Sunderland^a about sending the Society's letters in the packets of the secretaries of state ; and that his lordship had readily given his consent thereto.

Mr. HOOKE was desired to get several experiments ready against the next meet-

^a Then secretary of state.

ing, by reason that some strangers would be present; and Mr. HUNT was ⁵⁷⁵ ordered to summon several of the members to be present.

Dr. GALE was desired to send a letter to the several persons in foreign parts, who had formerly corresponded with the Society, and particularly to Mr. PUL-
LEIN concerning Signor MALPIGHI, and to assure them of a constant correspond-
ence for the future.

Dr. GALE, Dr. CROUNE, Dr. ALLEN, Mr. HILL, and Mr. HOOKS were ap-
pointed a committee to see, that a partition be put up in the long gallery of Gre-
ham college.

Dr. GREW mentioned, that Mr. MANWARING was going to the Indies, and
undertook to have barometers sent to the Indies and Barbadoes, with full directions
for the use of them, and to procure an account from thence of what observations
should be made.

Dr. GALE promised to give the Society for their library all the works of Sco-
TUS.

Sir ROBERT SOUTHWELL promised to give WECKERUS *De Secretis Medicinae*.

It was ordered, that a paper-book be forthwith provided, in which shall be
entered all the transactions of the council:

That a particular book be provided for entering all such letters, as are written
by the secretaries to the several correspondents at home and abroad; and another
for copying all such answers and returns, as come to the Society or secretaries,
from abroad or from any part of England, Scotland, or Ireland.

That a committee be appointed to view the former Letter-books, to see how
perfect the entries are; and to take an account of all loose letters recovered from
the administratrix of Mr. OLDENBURG, and of those, that have come to the se-
cretaries since; and to take care, that those, that are not yet entered, be entered
forthwith, and that the originals be with all care got together, in order to their
being preserved in such way as the Society shall direct. Mr. HILL, Sir JOHN
HOSKYNs, Dr. GALE, and Dr. CROUNE, or any two of them, were appointed of
this committee.

That a particular press be provided to be placed in the gallery appointed for
the library, for keeping of all the letters, papers, and books of entries, Journals,
Registers, and all other written books of the Society under the custody of the
secretaries; and that a note or list be made of all such, as then were or should
hereafter be in their keeping, to be for the future interchangeably signed between
the president and the secretaries; and that those letters be examined once a year,
as at St. Andrew's day:

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That

That some of the best and most entertaining experiments produced before the Society be set apart, and a list taken of them to be at hand, for the entertainment of any person of quality, &c. who shall visit the Society: and

That a committee of experiments be appointed every year, 1. To make a list of what authors have written of physico-mathematical matters: 2. That they charge themselves with one or more of the said authors; and that it be recommended to others of the Society to take part of the rest of such authors for the reading them over, and extracting out of them the principal experiments there-in mentioned. 3. That all such experiments so extracted be brought into the committee for experiments, and by them considered of, in order to the presenting to the Society such of them, as they shall think fit to offer to the Society to proceed upon.

December 11. At a meeting of the Society, Mr. HENSHAW, vice-president, in the chair.

A foreign count was introduced by Mr. EVELYN, together with two other strangers, who had before the sitting of the Society been shewn the repository, the library, and particularly the weather-clock, &c.

The minutes of December 4. were read and approved; and upon the mention of Mr. EVELYN's undertaking to speak to the earl of Sunderland, he being present gave the Society an account, that he had accordingly spoken with his lordship concerning the conveyance of the letters of the Society to and from foreign correspondents in his packet; to which the earl very freely and obligingly gave his consent; for which favour the Society desired, that their thanks might be returned to his lordship by Mr. EVELYN, who was likewise thanked by them for his great care and expedition in this affair.

Upon the mentioning of Mr. NEWTON's letter, and the experiment proposed in it, Mr. HOOKE read his answer to him upon that subject, wherein he explained what the line described by a falling body must be supposed to be, moved circularly by the diurnal motion of the earth, and perpendicularly by the power of gravity: and he shewed, that it would not be a spiral line, as Mr. NEWTON seemed to suppose, but an excentrical ellipsoid, supposing no resistance in the medium: but supposing a resistance, it would be an excentric ellipti-spiral, which, after many revolutions, would rest at last in the centre: that the fall of the heavy body would not be directly east, as Mr. NEWTON supposed; but to the south-east, and more to the south than the east. It was desired, that what was tryable in this experiment might be done with the first opportunity.

Mr. HOOKE read an account, which he had procured from Mr. BEAUMONT, of several observations made by himself in divers subterraneous caverns in Somersetshire, viz. in Okey-hole, in a cavern near Cheddar, and in the hill called Lamb,
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{above

above the parish of Harptry among Mendipp Hills; which account Mr. Hooke⁵¹⁷ intended to print the first opportunity".

Hereupon much discourse was maintained about the poisonous nature of several mineral waters. Sir JOHN LOWTHER mentioned an observation, which had been made by a friend of his, that upon the breaking out of water from a coal-mine, and running into places, where were store of fish, all the fish were observed to be killed thereby.

Mr. HENSHAW mentioned, that it was an usual observation, that plumbers could not keep their cats from being killed by licking up the duff of their lead.

Dr. KING mentioned, that he living near the white lead works in Hatton Garden, had divers times patients of the labourers in them, sometimes taken with convulsions, sometimes with palsies, sometimes with gripings in their guts, divers of them speechless.

It was remarked likewise, that divers plumbers and gilders are observed to be paralytic; &c.

All which effects were ascribed to the noxious steams proceeding from those metals, upon which they wrought.

Mr. HOOKE mentioned, that he had received a letter from Mr. WILLIAM BALLE, and another from Dr. BEAL; but it being pretty late, the Society desired to have an account of them at another time, and rose to observe the experiments.

1. An account was given by Mr. HOOKE of the experiment for examining the weight of tin, copper, and the mixture of tin and copper, and the way and reason thereof explained.
2. The experiments formerly in the Society were again exhibited for the entertainment of the foreign count then present, viz. those for explaining the nature of fire; the first of which was that of a chafing-dish of burning coals included in a box with bellows to blow the fatiated air upon them: the second was that of sealing up a charcoal in a pipe of glass, and keeping it in a very hot fire for about an hour and an half; the effects of both which were the same with those, that had been formerly shewn in the Society, and entered into the Journals.

MONS. PAPIN produced a peach, which he had the last summer inclosed in a glass with artificial air condensed, and on cutting the same, it was found very sound and plump. He gave no farther account thereof, but that it was an experiment of Mr. BOYLE, of which he was now printing an account, which would shortly be published.

^a It is published in his Philosophical Collections, n^o 2. p. 1. at London, 1681. in 4to.

Mons. PAPIN produced likewise his wind-gun made in a walking-stick, with which he shewed, first, the extraordinary condensation of the air therein, by letting it leisurely out into a glass filled with water; of which an account is made in the Journal book:

And next he charging it again with condensed air, shot a bullet with it in the gallery; the effect being much the same with those of some other experiments in the same gun formerly made use of; accounts of which were entered in the Journal-books of this year.

Mr. THOMAS PICOT, fellow of Wadham College in Oxford, was proposed a candidate by Sir JOHN HOSKYNs.

December 17. At a meeting of the COUNCIL, at the president's house, were present,

	Sir JOSEPH WILLIAMSON, president,
Sir ROBERT SOUTHWELL,	Dr. CROUNE,
Sir WILLIAM PETTY,	Dr. GREW,
Sir JOHN HOSKYNs,	Dr. KING,
Mr. HENSHAW,	Mr. HILL,
Dr. HOLDER,	Mr. HOOKE.
Dr. GALE,	

Mr. HILL, Dr. GALE, Dr. CROUNE and Sir JOHN HOSKYNs were appointed a committee to meet at Mr. HOOKE's lodgings on the Monday following, to see the letters in his custody.

It was ordered, that a list be made by the secretaries of all letters, that had come to their hands during the whole year; and that at the end of each year such a list be delivered to the president.

Mr. HOOKE was desired to continue the *Philosophical Collections*.

Dr. GALE was desired to undertake all foreign correspondence, which he accordingly did; as also that he would forthwith write to Signor MALPIGHI, BORELLI, and Mr. PULLEIN; and that he would apologize to the correspondents for the defect of returns; which should have been made from hence.

* The first number was printed at London, 1679, in 4to. by Mr. MARTYN, printer to the Society, under this title: *Philosophical Collections, containing an account of such physical, anatomical, chymical, mechanical, astronomical, optical, or other mathematical have lately come to the publisher's hands. As also are The second Number was printed at London, for MORIS VET. in 1681; the third for R. CHISWELL,*

and dated December 10, 1681, with an Advertisement, that these *Collections* would for the future be published once a month at least; wherein would be contained an account of all such new discoveries of nature or art, as should occur to the collector in the modern books or writings of learned men, either at home or abroad. The fourth Number is dated, January 10, 1682. the fifth, in February, 1682; the sixth, in March, 1682; and the seventh, and last in April, 1682.

Mr.

1679.] ROYAL SOCIETY OF LONDON.

Mr. Hooke's propounding, that it was necessary for him to have a person, who might be constantly by him, and employed in the making and preparing of such trials and experiments, as should, when perfected, be shewn and represented to the Society at their meetings; it was ordered, that he should have liberty forthwith to employ such person, as he should agree with; and that the Society would allow for the hire of such person thirty-two pounds per annum.

December 18. At a meeting of the Society, Mr. HENSHAW, vice-president, in the chair.

WILLIAM NAPPER, Esq; was admitted.
WILLIAM BRIDGEMAN, Esq; and Mr. PICOT were elected.

Mr. JOSEPH MOXON presented to the Society one of his English globes, together with a book, containing the explanation and use thereof, with a desire, that it might stand in the meeting-room, to be seen at the meetings of the Society. And Mr. HENT was directed to get a wooden case made for it to stand in the meeting-room.

Mr. Hooke read his answer to Mr. NEWTON's former letter, as also another letter, which he had received from Mr. NEWTON, containing his farther thoughts and examinations of what had been propounded by Mr. Hooke.

Mr. Hooke gave also an account, that he had made three trials of the experiment propounded by Mr. NEWTON, and had found the ball in every one of the said experiments fall to the south-east of the perpendicular point, found by the same ball hanging perpendicular. But the distance of it from the perpendicular point being not always the same, and the experiment having been made without doubt in the open air, nothing of certainty could be concluded from it. But he alleged, that he designed to make a trial of it within doors, where there would be less motion of the air; and he hoped to be able to do it before the next meeting of the Society.

Mr. Hooke read a letter of ERASMUS BARTHOLINE, which he had received from the president, directed to Dr. CRAW, and dated at Copenhagen, 23d February, 1679; in which the writer expressed his readiness to correspond, and inclosed a treatise of his nephew, CASPAR BARTHOLINE, De Organis Olfactus, which treatise was delivered to Dr. CROWE to peruse and give an account of it at the next meeting, in order that an answer might be sent to the letter.

Mr. HENSHAW presented the Society with a printed account of the great loss sustained by Mr. HAVELIN in the late fire at Dantzick, which account was sent from Hamburg by Sir PETER WROCHE, to whom that account was dedicated.

Mr. Hooke's Philosophical

Transactions, n^o 1. P. 43.

Letter-book, vol. viii. n^o 68. Mr.

Mr. Hooke shewed a new book of Signor VIVIANI, sent to himself by the author, containing several solutions of the problem propounded by Mr. CONYERS of trifecting an angle, and finding two mean proportionals. Two other copies were likewise sent, one for the president, and the other for Mr. COLLINS, which were accordingly delivered.

Hereupon Sir ROBERT SOUTHWELL promised to present to the Society for their library Signor VIVIANI's book *De Maximis & Minimis*.

Mr. HENSHAW read a paper, which he had received from Dr. PLOT, copied from the Records in the Tower, containing an account of the strange recovery of certain persons a long time after their having been executed.

The experiments shewn were the trials with the box, in which the chafing-dish of live coals were placed; and the time was observed, how long it continued there, before the coals seemed quite extinct and black. Then the same chafing-dish was again filled with live coals, and included, and the bellows were kept continually blowing upon them; and the time being also observed, how long it was before they also were quite extinct, it was found, that the times of continuance in both experiments were the same.

There were two other experiments ready, which the Society had not time to see tried, it being late; for which reason they were referred to the next meeting.

THE END OF THE THIRD VOLUME.

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